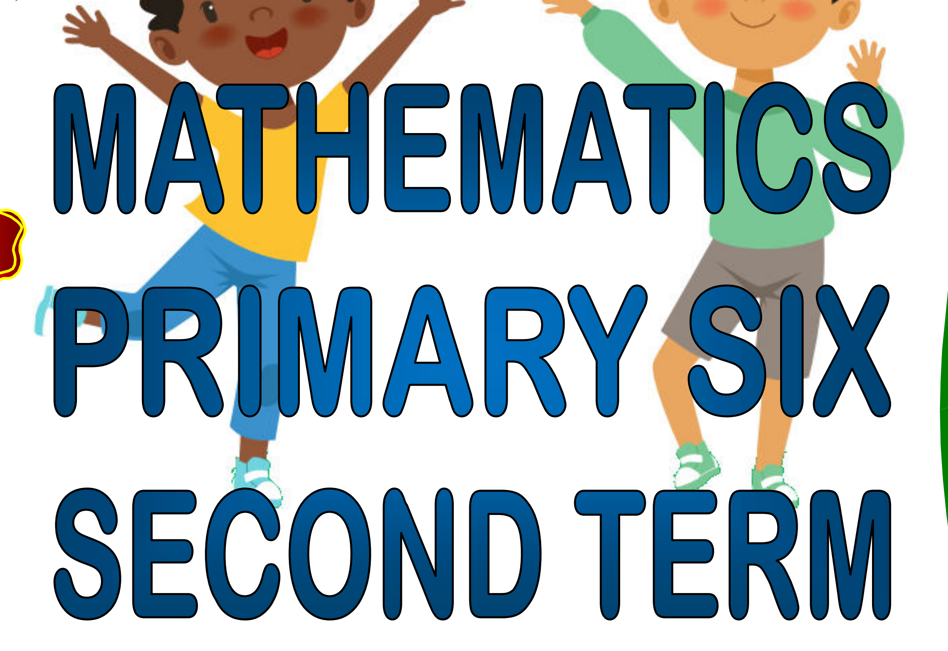


# MATHEMATICS PRIMARY SIX SECOND TERM







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UNIT 8

Theme 3 | Fractions, Decimals, and Proportional Relationships: Ratios and Proportional Relationships

# Operations on Fractions and Decimals

# Concept (1): Operations on Fractions & Decimal

**Lesson (1)** Modeling Division with Fractions and Whole Numbers
**Lesson (2)** Modeling Fraction Division with Tape Diagrams

## Modeling dividing a Whole Number by a fraction:

| 1 | | | 1 | | |
|---|---|---|---|---|---|
| $\frac{1}{3}$ | $\frac{1}{3}$ | $\frac{1}{3}$ | $\frac{1}{3}$ | $\frac{1}{3}$ | $\frac{1}{3}$ |

$$2 \div \frac{2}{3} = 3$$



## Modeling dividing a Whole Number by a fraction with remainder:

| 1 | | | 1 | | | 1 | | |
|---|---|---|---|---|---|---|---|---|
| $\frac{1}{3}$ | $\frac{1}{3}$ | $\frac{1}{3}$ | $\frac{1}{3}$ | $\frac{1}{3}$ | $\frac{1}{3}$ | $\frac{1}{3}$ | $\frac{1}{3}$ | |

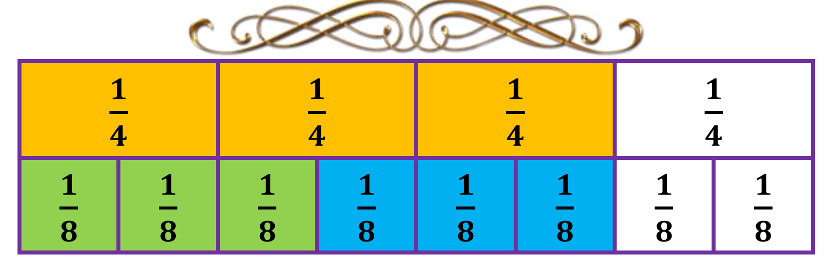
$$3 \div \frac{2}{3} = 4\frac{1}{2}$$



## Modeling dividing a fraction by a Whole Number:

| $\frac{1}{5}$ | | $\frac{1}{5}$ | | $\frac{1}{5}$ | | $\frac{1}{5}$ | | $\frac{1}{5}$ | |
|---|---|---|---|---|---|---|---|---|---|
| $\frac{1}{10}$ | | | | | | | | | |

$$\frac{2}{5} \div 4 = \frac{1}{10}$$



| $\frac{1}{4}$ | | $\frac{1}{4}$ | | $\frac{1}{4}$ | | $\frac{1}{4}$ | |
|---|---|---|---|---|---|---|---|
| $\frac{1}{8}$ | $\frac{1}{8}$ | $\frac{1}{8}$ | $\frac{1}{8}$ | $\frac{1}{8}$ | $\frac{1}{8}$ | $\frac{1}{8}$ | $\frac{1}{8}$ |

$$\frac{3}{4} \div 2 = \frac{3}{8}$$



## Modeling dividing a fraction by another fraction:

| $\frac{1}{10}$ | $\frac{1}{10}$ | $\frac{1}{10}$ | $\frac{1}{10}$ | $\frac{1}{10}$ | $\frac{1}{10}$ | $\frac{1}{10}$ | $\frac{1}{10}$ | $\frac{1}{10}$ | $\frac{1}{10}$ |
|---|---|---|---|---|---|---|---|---|---|
| $\frac{1}{5}$ | | $\frac{1}{5}$ | | $\frac{1}{5}$ | | $\frac{1}{5}$ | | $\frac{1}{5}$ | |

$$\frac{8}{10} \div \frac{2}{5} = 2$$



## Modeling dividing a fraction by another fraction with remainder:

| $\frac{1}{10}$ | $\frac{1}{10}$ | $\frac{1}{10}$ | $\frac{1}{10}$ | $\frac{1}{10}$ | $\frac{1}{10}$ | $\frac{1}{10}$ | $\frac{1}{10}$ | $\frac{1}{10}$ | $\frac{1}{10}$ |
|---|---|---|---|---|---|---|---|---|---|
| $\frac{1}{5}$ | | $\frac{1}{5}$ | | $\frac{1}{5}$ | | $\frac{1}{5}$ | | | |

$$\frac{9}{10} \div \frac{1}{5} = 4\frac{1}{2}$$

## Homework

### [1] Choose the correct answer:

**(1)** $\frac{1}{2} \div 8 =$ .........

| $\frac{1}{2}$ | | | | | | | |
|---|---|---|---|---|---|---|---|
| $\frac{1}{16}$ | $\frac{1}{16}$ | $\frac{1}{16}$ | $\frac{1}{16}$ | $\frac{1}{16}$ | $\frac{1}{16}$ | $\frac{1}{16}$ | $\frac{1}{16}$ |

(a) 4 (b) $\frac{1}{4}$ (c) $\frac{1}{8}$ (d) $\frac{1}{16}$

**(2)** $\frac{1}{4} \div 5 =$ .........

| $\frac{1}{4}$ | | | | |
|---|---|---|---|---|
| $\frac{1}{20}$ | $\frac{1}{20}$ | $\frac{1}{20}$ | $\frac{1}{20}$ | $\frac{1}{20}$ |

(a) $\frac{1}{20}$ (b) 5 (c) 20 (d) $\frac{4}{5}$

**(3)** $4 \div \frac{1}{3} =$ .........

| 1 | | | 1 | | | 1 | | | 1 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $\frac{1}{3}$ | $\frac{1}{3}$ | $\frac{1}{3}$ | $\frac{1}{3}$ | $\frac{1}{3}$ | $\frac{1}{3}$ | $\frac{1}{3}$ | $\frac{1}{3}$ | $\frac{1}{3}$ | $\frac{1}{3}$ | $\frac{1}{3}$ | $\frac{1}{3}$ |

(a) $\frac{3}{4}$ (b) 4 (c) 12 (d) 6

**(4)** $8 \div \frac{1}{2} =$ .........

| 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | | 1 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ | $\frac{1}{2}$ |

(a) 4 (b) 16 (c) 8 (d) 2

# Lesson (3) Connecting Fraction Multiplication to Fraction Division

## [1] Complete the table:

| | Division expression | Multiplication expression | Deduction |
|---|---|---|---|
| $\frac{1}{3}$ of 12 | $12 \div 3$ | $12 \times \frac{1}{3}$ | $12 \div 3 = 12 \times \frac{1}{3}$ |
| Half of 8 | | | |
| Fourth of 12 | | | |



## [2] Write the reciprocal of each of the following:

(1) $\frac{1}{3}$ ..................................................

(2) $\frac{3}{7}$ ..................................................

(3) 2 ..................................................

(4) 1 ..................................................

(5) 0 ..................................................

(6) $2\frac{1}{2}$ ..................................................

(7) $3\frac{2}{5}$ ..................................................



## [3] Find the quotient in the simplest form:

(1) $2 \div \frac{1}{3} =$ ..................................................

(2) $6 \div \frac{2}{3} =$ ..................................................

**(3)** $\frac{1}{3} \div 6 =$ ..............................

**(4)** $\frac{3}{4} \div 2 =$ ..............................

**(5)** $\frac{5}{6} \div \frac{2}{3} =$ ..............................

**(6)** $\frac{7}{8} \div \frac{3}{4} =$ ..............................



## [4] Answer the following questions:

**(1)** How many $\frac{1}{4}$ are there in 2? ..............................

**(2)** How many $\frac{1}{4}$ are there in $\frac{3}{4}$? ..............................



## [5] Find the result of each of the following:

**(1)** $\frac{1}{4}$ of $\frac{3}{4}$ ? ..............................

**(2)** Fifth of 20? ..............................

**(3)** $\frac{1}{9}$ of 27? ..............................



## [6] Find the result of each of the following:

**(1)** ...... $\times \frac{2}{3} = \frac{4}{5}$ ..............................

**(2)** $\frac{3}{7} \times$ ...... $= 1$ ..............................

**(3)** $\frac{2}{5} \div$ ...... $= \frac{2}{4}$ ..............................

**(4)** ...... $\div \frac{2}{7} = 3$ ..............................



[7] A runner covered $\frac{2}{3}$ Km in 4 laps.

How many km did he make in one lap?



....................................................................................................



[8] You have 2 L of paint and you need to divide it into $\frac{3}{5}$ L containers. How many containers needed?



....................................................................................................



## [9] Choose the correct answer:

(1) $4 \div \frac{1}{5} =$ ....................................

ⓐ 4 ⓑ 5 ⓒ 20 ⓓ $\frac{4}{5}$

(2) $\frac{2}{7} \div 2 =$ ....................................

ⓐ 7 ⓑ 4 ⓒ $\frac{4}{7}$ ⓓ $\frac{1}{7}$

(3) $\frac{4}{5} \div 2 =$ ....................................

ⓐ $\frac{8}{5}$ ⓑ $\frac{2}{5}$ ⓒ $\frac{7}{5}$ ⓓ $\frac{1}{5}$

(4) $5 \div \frac{3}{6} =$ ....................................

ⓐ $\frac{15}{6}$ ⓑ $\frac{1}{2}$ ⓒ 10 ⓓ 15

(5) $\frac{4}{5} \div \frac{1}{2} =$ ....................................

ⓐ $\frac{2}{5}$ ⓑ $\frac{4}{10}$ ⓒ $1\frac{4}{5}$ ⓓ $1\frac{3}{5}$

(6) $\frac{3}{8} \div \frac{3}{4} =$ ....................................

ⓐ $\frac{1}{2}$ ⓑ $\frac{9}{32}$ ⓒ 2 ⓓ $1\frac{1}{8}$



# Homework

## [1] Complete the table:

| | Division expression | Multiplication expression | Deduction |
|---|---|---|---|
| $\frac{1}{3}$ of 12 | $12 \div 3$ | $12 \times \frac{1}{3}$ | $12 \div 3 = 12 \times \frac{1}{3}$ |
| Fifth of 25 | | | |
| $\frac{1}{7}$ of 14 | | | |



## [2] Write the reciprocal of each of the following:

(1) $\frac{1}{5}$ ..........................................

(2) $\frac{5}{8}$ ..........................................

(3) 3 ..........................................

(4) 2 ..........................................

(5) 0 ..........................................



## [3] Answer the following questions:

(1) How many $\frac{1}{3}$ are there in 2? ..........................................

(2) How many $\frac{1}{5}$ are there in $\frac{4}{5}$? ..........................................



## [4] Find the quotient in the simplest form:

(1) $4 \div \frac{2}{3} =$ ..............................

(2) $\frac{1}{3} \div 5 =$ ..............................

(3) $\frac{7}{8} \div \frac{3}{4} =$ ..............................



## [5] Find the result of each of the following:

(1) $\frac{1}{8}$ of $\frac{3}{8}$ ? ..............................

(2) Fourth of 20 ? ..............................

(3) $\frac{1}{9}$ of 18 ? ..............................



## [6] Find the result of each of the following:

(1) ...... $\times \frac{2}{3} = \frac{4}{5}$ ..............................

(2) $\frac{3}{7} \times$ ...... $= 1$ ..............................

(3) $\frac{2}{5} \div$ ...... $= \frac{2}{4}$ ..............................

(4) ...... $\div \frac{2}{7} = 3$ ..............................



**[7]** Making your recipe requires $\frac{2}{5}$ cup of flour, you have $\frac{3}{4}$ cup of flour. How many batches can you make?



..............................



[8] You have $\frac{9}{10}$ kg of clay. You want to make portions that are $\frac{3}{5}$ kg each. How many portions can you make?



..............................................................................................................

## [9] Choose the correct answer:

**(1)** $... \times \frac{3}{5} = 1$ ..............................................

ⓐ $\frac{3}{5}$ ⓑ $1\frac{2}{3}$ ⓒ 1 ⓓ $\frac{8}{5}$

**(2)** $... \times 1\frac{1}{2} = 1$ ..............................................

ⓐ $\frac{2}{3}$ ⓑ $\frac{3}{2}$ ⓒ $2\frac{1}{2}$ ⓓ 1

**(3)** $5 \div \frac{1}{2} =$ ..............................................

ⓐ $\frac{5}{2}$ ⓑ $\frac{2}{5}$ ⓒ 10 ⓓ 1

**(4)** $\frac{3}{4} \div 3 =$ ..............................................

ⓐ 1 ⓑ $\frac{4}{3}$ ⓒ $\frac{9}{4}$ ⓓ $\frac{1}{4}$

**(5)** $\frac{3}{5} \div \frac{3}{5} =$ ..............................................

ⓐ $\frac{9}{25}$ ⓑ $\frac{5}{3}$ ⓒ $\frac{3}{5}$ ⓓ 1

**(6)** $\frac{2}{7} \div \frac{2}{5} =$ ..............................................

ⓐ $\frac{5}{7}$ ⓑ $\frac{7}{5}$ ⓒ $\frac{4}{35}$ ⓓ 1

**(7)** Half of 22 = ..............................................

ⓐ 22 ⓑ 11 ⓒ 2 ⓓ 44

**(8)** $\frac{3}{7}$ of $\frac{7}{3}$ = ..............................................

ⓐ $\frac{21}{7}$ ⓑ $\frac{21}{3}$ ⓒ $\frac{7}{21}$ ⓓ 1

## Lesson (4) Analyzing Multiplying and Dividing Fractions and Decimals

### [1] Place the decimal point in its correct place:

| | | |
|---|---|---|
| 1.2 × 2.4 = 2 8 8 | 4.8 × 1.3 = 6 2 4 | 7.4 × 0.1 = 7 4 |
| 6.9 × 3 = 2 0 7 | 1.7 5 × 2.3 = 4 0 2 5 | 1 5.8 5 × 4.3 = 6 8 1 5 5 |



### [2] Find the product for each multiplication problem:

a. 2.43 × 6.9 = ..........

b. 29.35 × 3.4 = ..........

c. 47.8 × 5.2 = ..........

### [3] Compare using (<), (>) or (=) without doing the multiplication:

a. 0.318 × 1.5 ◯ 3.18 × 0.15

b. 0.75 × 0.02 ◯ 7.5 × 0.2

c. 13.6 × 0.4 ◯ 0.136 × 0.4

d. 7.3 × 0.28 ◯ 0.73 × 2.8

### [4] Complete as the example:

(1) 4.2 ÷ 0.7 = 42 ÷ 7 = 6

(2) 3.5 ÷ 0.5 = ......... ÷ ......... = .........




(3) 3.6 ÷ 0.9 = ……… ÷ ……… = ………

(4) 0.28 ÷ 0.09 = ……… ÷ ……… = ………



## [5] Find the quotient:

1. $2.2\overline{)26.4}$
2. $0.4\overline{)99}$
3. $0.04\overline{)1.5}$



[6] Ali wants to buy 3 shirts that of 25.8 L.E. each.

How much will he pay?



……………………………………………………………………………………………

[7] A train covered 221.65 km in 2.75 hours. How many kilometers covered in one hour?



……………………………………………………………………………………………



## Homework

### [1] Place the decimal point in its correct place:

| | | |
|---|---|---|
| 3.1 4<br>× 0.0 5<br>1 5 70 | 4.1 6<br>× 0.4 1<br>1 7 0 5 6 | 0.0 9<br>× 0.3<br>2 7 |
| 0.0 0 8<br>× 7<br>5 6 | 0.2 4<br>× 0.3 9 8<br>9 5 5 2 | 2 7.1<br>× 1 3.4<br>3 6 3 1 4 |



### [2] Find the product for each multiplication problem:

**e.** 9.72 × 0.46 = ..........

**f.** 1.74 × 35 = ..........

**g.** 10.21 × 0.64 = ..........

### [3] Compare using (<), (>) or (=) without doing the multiplication:

e. 0.342 × 1.2  3.42 × 0.12

f. 172 × 0.003  0.172 × 0.3

g. 48.2 × 3.7  4.82 × 37

h. 42 × 1.532 ◯ 4.2 × 15.32

### [4] Complete:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| (1) | 4.5 | ÷ | 0.5 | = | ......... | ÷ | ......... | = | ......... |
| (2) | 3.6 | ÷ | 0.4 | = | ......... | ÷ | ......... | = | ......... |
| (3) | 0.8 | ÷ | 0.2 | = | ......... | ÷ | ......... | = | ......... |

## [5] Find the quotient:

| | |
|---|---|
| 1. $1.9\overline{)9.956}$ | 4. $0.05\overline{)1.43}$ |
| 2. $7.3\overline{)3.431}$ | 5. $0.5\overline{)44}$ |
| 3. $0.04\overline{)0.51}$ | 6. $0.7\overline{)70}$ |

## [6] Choose the correct answer:

**(1)** $2.3 \times 4 =$ .........

ⓐ 9.2 ⓑ 92 ⓒ 8.2 ⓓ 7.2

**(2)** $0.56 \times 0.2 =$ .........

ⓐ 11.12 ⓑ 0.112 ⓒ 11.2 ⓓ 0.0112

**(3)** $0.676 \times 0.1 =$ .........

ⓐ 67.6 ⓑ 0.0676 ⓒ 6.76 ⓓ 6760

**(4)** $3.4 \times 6.2 =$ .........

ⓐ 2.108 ⓑ 21.08 ⓒ 210.8 ⓓ 2108

**(5)** $54.45 \div 0.9 =$ ...........

ⓐ 60.5 ⓑ 605 ⓒ 0.605 ⓓ 6.05

**(6)** $1.2 \div 0.4 =$ ...........

ⓐ 3 ⓑ 30 ⓒ 300 ⓓ 0.3

**(7)** $87.29 \div 0.29 = 872.9 \div$ ...........

ⓐ 2.9 ⓑ 29 ⓒ 290 ⓓ 0.29

**(8)** $327 \div 24 = 3.27 \div$ ...........

ⓐ 2.4 ⓑ 0.24 ⓒ 24 ⓓ 240

**(9)** If $123 \times 45 = 5535$, then $1.23 \times 4.5 =$ ...........

ⓐ 5.535 ⓑ 55.35 ⓒ 553.5 ⓓ 5535

**(10)** If $48 \times 36 = 1728$, then $17.28 \div 0.36 =$ ...........

ⓐ 480 ⓑ 48 ⓒ 0.48 ⓓ 4.8



# Unit (8) Assessment

## [1] Choose the correct answer:

(1) $\ldots \times \frac{2}{7} = 1$ ..........

ⓐ $\frac{2}{7}$ ⓑ 0 ⓒ 1 ⓓ $\frac{7}{2}$

(2) $5 \div \frac{1}{3} =$ ..........

ⓐ $\frac{5}{3}$ ⓑ $\frac{3}{5}$ ⓒ $5\frac{1}{3}$ ⓓ 15

(3) $2.1 \times 0.3 =$ ..........

ⓐ 6.3 ⓑ 0.63 ⓒ 63 ⓓ 0.063

(4) If $15.25 \div 0.25 = 61$, then $1.525 \div 0.025 =$ ..........

ⓐ 61 ⓑ 610 ⓒ 6.1 ⓓ 0.61

(5) $\frac{2}{3} \div \frac{2}{5} =$ ..........

ⓐ $\frac{4}{15}$ ⓑ $1\frac{2}{3}$ ⓒ $\frac{15}{4}$ ⓓ $\frac{1}{15}$

(6) $\frac{3}{4} \div 2 =$ ..........

ⓐ $\frac{3}{8}$ ⓑ $\frac{6}{4}$ ⓒ $\frac{4}{6}$ ⓓ $\frac{3}{2}$

(7) Half of 12 = ..........

ⓐ 12 ⓑ 6 ⓒ 24 ⓓ 3

(8) $0.33 \div 0.011 =$ .......... $\div 11$

ⓐ 33 ⓑ 330 ⓒ 3300 ⓓ 0.33



## [2] Complete:

(1) If $31 \times 25 = 775$, then $0.31 \times 2.5 =$ ..........

(2) $\frac{4}{13} \div \frac{1}{13} =$ ..........

(3) $5 \div \frac{2}{3} =$ ..........

(4) Fifth of 35 = ..........





UNIT 9

Theme 3 | Fractions, Decimals, and Proportional Relationships: Ratios and Proportional Relationships

# Ratios

# Concept (1): Understand Ratios

## Lesson (1) Exploring Ratios and Rates with Real-World Situations

**Ratio:** It is a wat to compare between two quantities of the same type (weights, lengths, areas, etc.). By Division

**For Example:**

If Doaa has L.E. 20 and Noha has L.E. 30, we can compare between what they have using ratios as:







Then the ratio of that Doaa has to Noha has is:

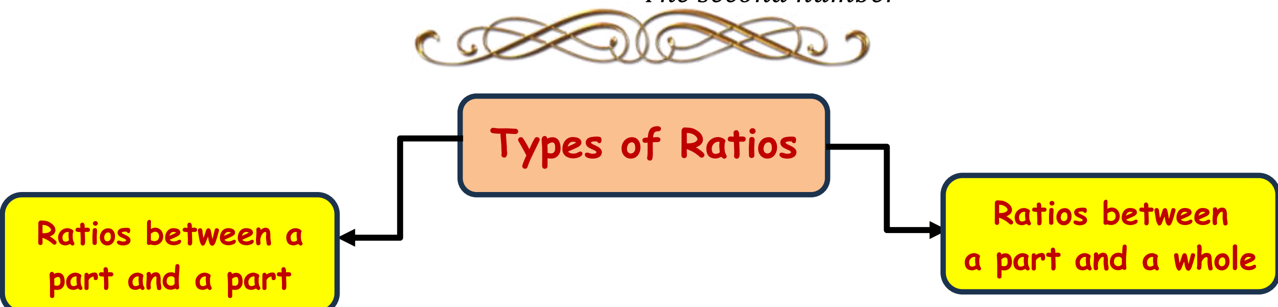
$\frac{20}{30}$ or 20:30 or 20 to 30



**Notice:**

- The numbers 20 and 30 are called ((terms of the ratio)).
- The ratio has the same properties as the fraction in terms of simplification and comparison.

So the ratio between two numbers = $\frac{\text{The first number}}{\text{The second number}}$ (in its simplest form)




**Example:** There are 6 **apples** and 8 **oranges** in a basket. To compare the numbers of fruits in the basket then:

## The ratio between part and whole

**1** **The ratio of the number of apples to the total number of fruits.**



| The Number of apples | | The total number of fruits |
|---|---|---|
| 6 | to | 14 |
| 6 | : | 14 |

$\frac{6}{14} = \frac{3}{7}$ (Simplifying)

**That means**

Number of apples = $\frac{3}{7}$ total number of fruits For every 7 fruits, 3 of them are apples.

## The ratio between a part and a part

**1** **The ratio of the number of apples to the number of oranges.**

| Number of apples | | Number of oranges |
|---|---|---|
| 6 | to | 8 |
| 6 | : | 8 |

$\frac{6}{8} = \frac{3}{4}$ (Simplifying)

**That means**

the number of apples = $\frac{3}{4}$ the number of oranges

For every 3 apples there are 4 oranges.

## Comparisons That Are Not Ratios

- There are two more oranges than apples
- The number of apples is two fewer than the number of oranges.



**Writing ratios in simplest form:**

- A ratio is in simplest form when the only common factor of its terms is 1
- To simplify a ratio to simplest form, divide both terms by their greatest common factor [G.C.F].

1.

**A class has 18 girls and 24 boys. Complete in the simplest form the ratio between:**

ⓐ The number of girls and the number of boys:

........ : ........

$\frac{\dots}{\dots} = \frac{\dots}{\dots}$

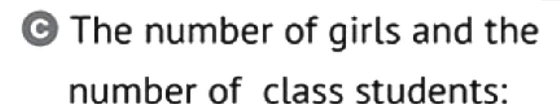
Number of girls = $\frac{\dots}{\dots}$ Number of boys.

ⓑ The number of boys and the number of girls:

........ : ........

$\frac{\dots}{\dots} = \frac{\dots}{\dots}$

Number of boys = $\frac{\dots}{\dots}$ Number of girls.



ⓒ The number of girls and the number of class students:

........ : ........

$\frac{\dots}{\dots} = \frac{\dots}{\dots}$

Number of girls

= $\frac{\dots}{\dots}$ Number of class students

ⓓ The number of boys and the number of class students:

........ : ........

$\frac{\dots}{\dots} = \frac{\dots}{\dots}$

Number of boys

= $\frac{\dots}{\dots}$ Number of class students

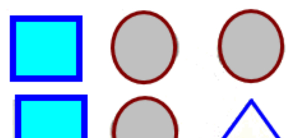
ⓔ The number of girls is ........ (less - more) than the number of boys by ........

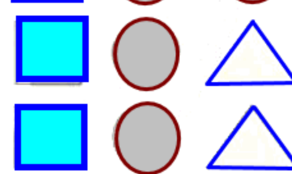
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2.

**By using the opposite figure,**

**Find in the simplest form the ratio between:**





ⓐ The number of squares to the number of circles

is ........ : ........

ⓑ The number of squares to the number of triangles

is ........ : ........

ⓒ The number of circles to the number of triangles is ........ : ........

ⓓ The number of squares to the number of all shapes is ........ : ........

ⓔ The number of triangles to the number of all shapes is ........ : ........

3.

**Find the ratio between each of the following in the simplest form:**

ⓐ 22 : 66

..............................

..............................

ⓑ 96 : 63

..............................

..............................

ⓒ 48 : 72

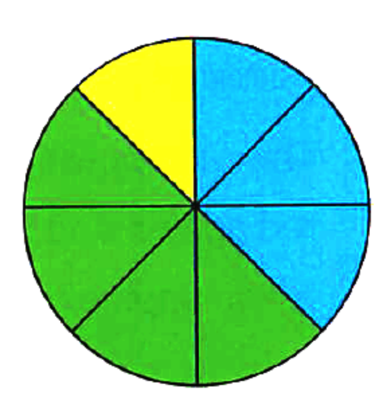
..............................

..............................



**4.**

**Look at the opposite figure, then complete each of the following :**



[a] $\frac{\text{Number of blue units}}{\text{Number of green units}} = \frac{\dots\dots}{\dots\dots}$

[b] $\frac{\text{Number of yellow units}}{\text{Number of blue units}} = \frac{\dots\dots}{\dots\dots}$

[c] Number of green units : number of yellow units = .......... : ..........

[d] Number of blue units : number of all units = .......... : ..........

[e] Number of yellow units = $\frac{\dots\dots}{\dots\dots}$ number of green units.

[f] Number of green units = $\frac{\dots\dots}{\dots\dots}$ number of all units.



## Remarks

1. In an equilateral triangle, the ratio of the side length to the perimeter is 1 : 3
2. In a square, the ratio of the side length to the perimeter is 1 : 4
3. In a rhombus, the ratio of the side length to the perimeter is 1 : 4
4. In a square, the ratio of any side length to another side length is 1 : 1
5. In a rhombus, the ratio of any side length to another side length is 1 : 1

**Rates:** A rate is a ratio of two quantities with different measurement units.

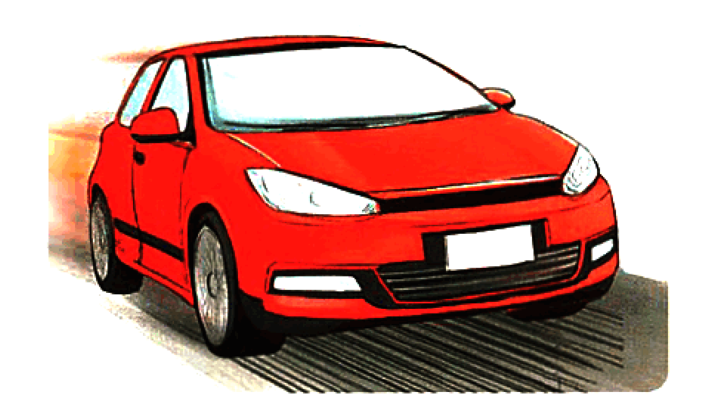
**Example, 1:**

If a car travels 300 km.

in 5 hours, the rate

is $\frac{300 \text{ km.}}{5 \text{ hours}}$

( km. and hour are different measurement units ).



**Example, 2:**

**Ahmed studies 28 hours a week. Find Ahmed's daily study rate.**

then: Daily study rate: 28 ÷ 7 = 4 hours/day

**Example, 3:** A typist types a sheet containing 630 words within 7 minutes. Find the rate of the typing.

**Then**: The rate of the typing = $\frac{630 \; wards}{7 \; minutes} = 90 \; words/min.$

**Choose the correct answer between brackets :**

[a] A tractor ploughs 14 feddans in 3.5 hours , then the rate of performance of the tractor = ………… feddans/hour ( $\frac{1}{4}$ or 4 or 10.5 or 7 )

[b] A factory produces 4 000 cans for juice during 8 hours , then the rate of the production is ………… cans/hour

( 32 000 or 500 or 5 000 or 4 008 )

[c] A machine produces 500 m. of material in 2 hours and half , then the rate of the production of this machine is ………… m./hour

( 400 or 125 or 1 000 or 200 )

[d] If Omar drinks 14 glasses of milk weekly , then the rate of what he drinks daily is ………… glasses. ( 3 or 7 or 14 or 2 )

## Homework

**Determine each of the following comparisons is a ratio or not.**

a. There are six students who like art compared to five students who like math.
b. Seven more students like art than math.
c. Seven out of twenty-eight students like adventure movies.
d. Fewer students like drama than adventure.
e. For every student who likes science, two students like math.
f. Five more students prefer fantasy than prefer drama.
g. The number of students who like art best compared to the number of students who like math best is twelve to five.

---

## Complete the following:

a) The ratio between 3,200 to 4,800 is .............. : ..............

b) The ratio between the side of an equilateral triangle to its perimeter is .............. : ..............

c) Farida spends 120 LE in 4 days, then the rate of what she spends = .............. LE/day.

---

## Choose the correct answer:

a) A a water tap is leaking 420 litres of water in one hour, then the rate of leaking = .................. L/min. ( 420 or 7 or 70 or 42)

b) Ahmed has 64 LE and Yasmin has 24 LE, then the ratio of what Yasmin has to Ahmed is .................. ( 8 : 3 or 3 : 8 or 6 : 8 or 8 : 32)

c) 35 : 20 = .............. : .............. ( 7 : 4 or 4 : 7 or 5 : 7 or 4 : 5)

d) An amount of food is distributed between two people in the ratio 3 : 4 then what the first person took = .................. the total. ( $\frac{3}{4}$ or $\frac{3}{7}$ or $\frac{4}{7}$ or $\frac{4}{3}$ )

e) The ratio between the perimeter of a square to its side length is .......... ( 4 : 1 or 1 : 3 or 3 : 1 or 1 : 4)

f) A factory produces 5,400 cans of soda in 6 hours, the rate of production is .................. cans/hour. ( 9 or 90 or 900 or 9000)

# Lesson (2) Lesson (3)

# Representing Ratios
# Exploring Equivalent Ratios

**Equivalent Ratios:** Two ratios are equivalent (equal).

Equivalent ratios are those that can be simplified or reduced to the same value.

ⓐ The ratios $\frac{8}{24}$ and $\frac{15}{45}$

When we put them in the simplest form we find:

$\frac{8}{24} = \frac{1}{3}$ , $\frac{15}{45} = \frac{1}{3}$

So, equivalent ratios

ⓑ The ratios $\frac{9}{21}$ and $\frac{16}{32}$

When we put them in the simplest form we find:

$\frac{9}{21} = \frac{3}{7}$ , $\frac{16}{32} = \frac{1}{2}$

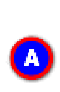
So, (not equivalent ratios)

For example: the ratios are equivalent.

$$\frac{2}{3} = \frac{4}{6} = \frac{6}{9} = \frac{8}{12} = \frac{10}{15}$$

1.

Complete the following ratio tables:



A

| 32 | ........ | 20 | ........ | 4 |
|---|---|---|---|---|
| ........ | 30 | ........ | 15 | 5 |

B

| 1 | 2 | ........ | 7 | ........ |
|---|---|---|---|---|
| 2 | ........ | 10 | ........ | 18 |

Match the equivalent ratios:

ⓐ 68 : 48

ⓑ 18 : 54

ⓒ 63 : 14

ⓓ 3200 : 4800

1. 72 : 16
2. 30 : 45
3. 85 : 60
4. 25 : 75

**3.**

**Determine whether the ratios are equivalent or not:**

ⓐ $\frac{10}{11}$ and $\frac{5}{3}$ ☐ ⓑ $\frac{7}{8}$ and $\frac{42}{48}$ ☐

ⓒ $\frac{5}{12}$ and $\frac{25}{60}$ ☐ ⓓ $\frac{10}{9}$ and $\frac{20}{18}$ ☐

ⓔ $\frac{7}{6}$ and $\frac{4}{3}$ ☐ ⓕ $\frac{6}{8}$ and $\frac{9}{13}$ ☐

**4.**

**Write two equivalent ratios:**

ⓐ $\frac{5}{9} = \frac{\dots}{\dots} = \frac{\dots}{\dots}$ ⓑ $\frac{2}{5} = \frac{\dots}{\dots} = \frac{\dots}{\dots}$

ⓒ $\frac{8}{11} = \frac{\dots}{\dots} = \frac{\dots}{\dots}$ ⓓ $\frac{3}{7} = \frac{\dots}{\dots} = \frac{\dots}{\dots}$

ⓔ $\frac{3}{8} = \frac{\dots}{\dots} = \frac{\dots}{\dots}$ ⓕ $\frac{1}{2} = \frac{\dots}{\dots} = \frac{\dots}{\dots}$

**5.**

**Complete.**

a. $\frac{3}{4} = \frac{--}{20}$

b. $\frac{8}{12} = \frac{—}{6}$

c. $\frac{8}{—} = \frac{24}{30}$

d. $\frac{—}{35} = \frac{10}{7}$

e. $\frac{—}{8} = \frac{3}{6}$

d. $\frac{—}{8} = \frac{3}{4}$

**6.**

**Complete.**

a. The ratio between a and b is 4 : 5
If a = 20 , then b = ......................

b. The ratio between two numbers is 2 : 7......................
If the greater number is 21 , then the smaller number is ......................

c. If the ratio between two numbers is 4 : 3 and the sum of them is 14 ,
then the two numbers are ................ ,......

## Homework

**1.**

**Complete each of the following tables to get equivalent ratios.**

a. ÷2 / ×2

| 2 | — | 8 | — | 15 | — |
|---|---|---|---|---|---|
| 1 | 2 | — | 9 | — | 27 |

b. ÷ — / × —

| 2 | 4 | 6 | — | — |
|---|---|---|---|---|
| 5 | — | — | 25 | 35 |

**2.**

**Complete the following:**

a. The ratio between two numbers is 3:4. The first number becomes 18, then the second number is ............... .

b. 5 : 7 = .......... : 35

c. The ratio between two numbers is 4:7. The second number becomes 35, then the first number is ..................

d. Write Two ratios that equal to third .................. and ... ....

e. $\frac{3}{5} = \frac{\dots}{15} = \frac{12}{\dots}$

f. $\frac{1}{7} = \frac{\dots}{21}$

g. If the ratio $\frac{2}{5}$ is equivalent to $\frac{4}{x}$, then $x$ equals ...............

**3.**

**Complete the table for a ratio of 3 dogs and 5 cats.**

| Total | Dog | Cat |
|---|---|---|
| 8 | 3 | 5 |
| 16 | (A) | (B) |
| (C) | 12 | (D) |

# Concept (2): Create Equivalent Ratios

**Lesson (4)** — Representing Ratios with Tope Diagrams
**Lesson (5)** — Analyzing Equivalent Ratios with a Number Line

## Learn 1: Representing ratios with tape diagrams.

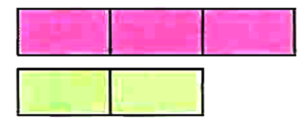
- Tape diagrams are visual models to represent the terms of a ratio using rectangles.
- You can use tape diagram to solve problems involving ratios.

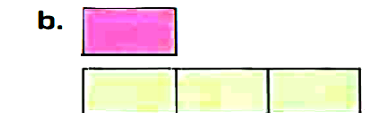


**Example1:** Represent the following ratios by tape diagrams.

**a)** 3:2 b)1:3

**Solution:**



b. 



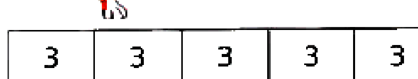
**Example2:** The ratio of small dogs to Large dogs at the dog show is 5 : 4. If there are 27 dogs in the show, how many Large dogs are there?

**Solution:**

Small dogs

Large dogs

All the tape diagram represents the 27 dogs in the show

then each box represents $27 \div 9 = 3$ ➡ Small dogs 


then the number of large dogs = 4 boxes of 3 ➡ Large dogs | 3 | 3 | 3 | 3 |

= 12 dogs



## Chose the correct answer :

1. The opposite tape diagram shows the ratio between oranges and apples. If the difference between them is 4 , then the sum of numbers oranges and apples is ..........

Oranges
Apples

A. 4 B. 8
C. 12 D. 20

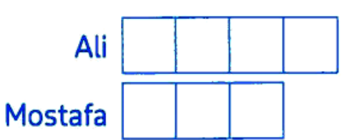
2. **Complete the following.**

a. If the ratio $\frac{4}{9}$ is equivalent to $\frac{12}{x-1}$ , then x = ..........

b. 100 : 150 = .......... : .......... (in the simplest form)

c. $5 \div \frac{1}{3} =$ .......... $\times 3$

d. From the opposite tape diagram , the ratio between Mostafa and Ali = $\frac{\quad}{\quad}$




e. The number .......... has no reciprocal.



3. a. If the ratio between number of boys and girls in a class is 4 : 5 and the number of boys is 20 boys. **Find the total pupils in the class by using tape diagram.**

..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................



4. If the ratio between cats and dogs in a street is 3 : 1 and you know what the number of dogs is 4

Complete the opposite table by the same ratio between number of cats and number of dogs.

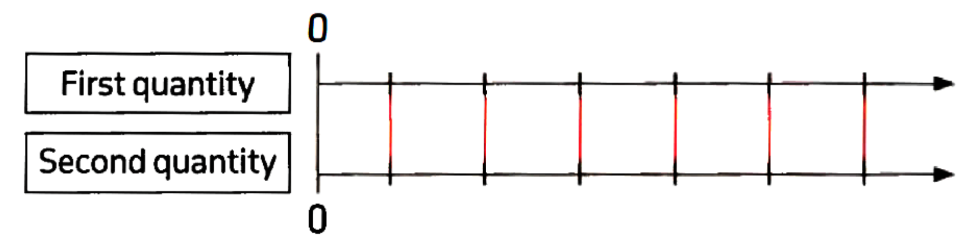
| Cats | 3 | 6 | 10 | Y | 24 |
|---|---|---|---|---|---|
| Dogs | 1 | X | M | 5 | Z |

Then: x =........ , M = ....... , Y= .......... , Z= ..........



## Learn 2: Analyzing equivalent ratios with double number line.

• A double number line is a pair of parallel, horizontal straight lines representing
the corresponding values of two quantities with a constant ratio as follows.






## Example1:

**The opposite table shows the distance in meters travelled by a car and the time taken in seconds.**

a. Represent this data by double number line.

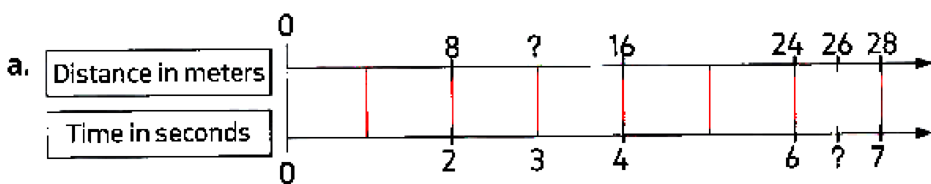
b. What is the travelled distance in 3 seconds ?

c. What is the time taken to travell 26 meters ?

| Distance in meters | Time in seconds |
|---|---|
| 8 | 2 |
| 16 | 4 |
| 24 | 6 |
| 28 | 7 |

## Solution:

a.




b. To find the travelled distance in 3 seconds,

since $\frac{8}{2} = \frac{\square}{3}$ [note : $\frac{8}{2} = \frac{4}{1}$]

$\frac{4}{1} = \frac{\square}{3}$ (× 3) then, the travelled distance = 4 × 3 = 12 meters

Another way : $\frac{\square}{3} = \frac{24}{6}$ (÷ 2) then, the travelled distance = 24 ÷ 2 = 12 meters



The following table shows the weight of oranges in kg and its price in L.E.

a. Represent the table by double number line.

b. Use double number line to find the price of 3 kg

c. Use double number line to find the weight of orange that cost 90 L.E.

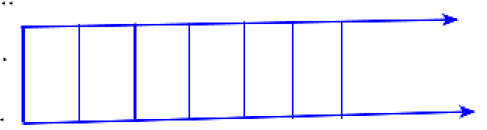
| The weight of oranges in kg | The price in L.E. |
|---|---|
| 1 | 15 |
| 2 | 30 |
| 4 | 60 |
| 5 | 75 |

.......................................................................................

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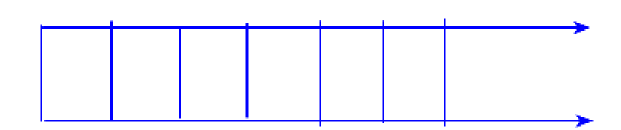
.......................................................................................



## 2.

Draw a tape diagram and write numbers on it to represent the ratio 3:6, then complete the following table:

| .......... | .......... | 3 | 4 | 5 |
|---|---|---|---|---|
| 2 | 4 | 6 | .......... | .......... |



## 3.

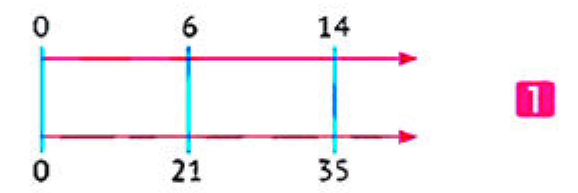
Match each ratio with the appropriate chart:

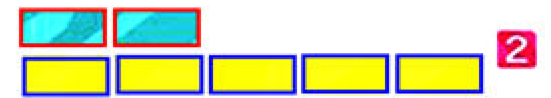
ⓐ 3 : 5

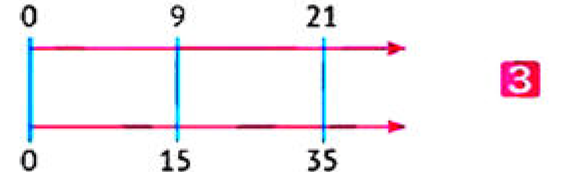
ⓑ $\frac{2}{7}$

ⓒ $\frac{2}{3}$

ⓓ 2 : 5




4

**4. Jana wants to plant her garden; she takes 4 minutes to plant a tree**

**a) Draw a tape diagram and write numbers on it to represent the ratio of the number of trees to the time it takes her to plant.**

……………………………………………………………………………

……………………………………………………………………………

**b) How long does it take her to plant 6 trees? ....................**

**c) How many trees she will plant in 120 minutes? ..................**




## [1] Complete:

(1) If the ratio $\frac{5}{6}$ is equivalent to $x - 1 : 12$, then $x =$ ……………

(2) The tape diagram (top row: 7 boxes; bottom row: 3 boxes) represents the ratio ..................

(3) 20 % of 80 = ……………

(4) From the opposite tape diagram, the ratio between Mostafa and Ali = $\frac{\dots}{\dots}$

Ali (4 boxes)

Mostafa (3 boxes)

(5) The missing number in the opposite double number line is ……………

| Time | 0 | 2 | 4 | 6 |
| --- | --- | --- | --- | --- |
| Distance | 0 | 7 | ..... | 21 |



## [2] Choose the correct answer:

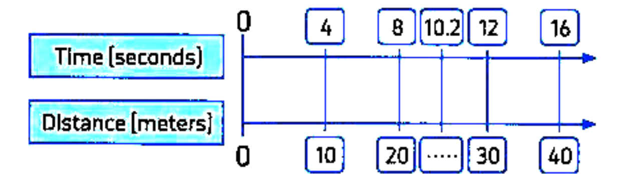
**(7)** If the percent of boys in a school is 52 % , then the percent of girls is %

ⓐ 52 ⓑ 48 ⓒ 0.48 ⓓ 0. 52

**(8)** The ratio 200 to 350 = [in simplest form]

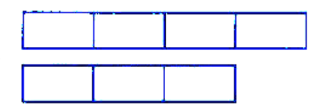
ⓐ 20:35 ⓑ 2:3 ⓒ 4:7 ⓓ 200:350

**(9)** The missing number in the opposite double number line is ……




ⓐ 20 ⓑ 25 ⓒ 30 ⓓ 25.5

**(10)** The opposite tape diagram represents the ratio ……



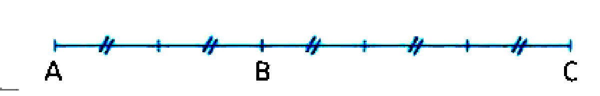
ⓐ 1:3 ⓑ 3:4 ⓒ 4:3 ⓓ 4:5

**(11)** From the opposite equivalent ratios , A + B = ……

| 4 | 36 | B |
|---|---|---|
| 9 | A | 36 |

ⓐ 95 ⓑ 96 ⓒ 97 ⓓ 98

**(7)** From the opposite figure , the ratio AB : CB = ……



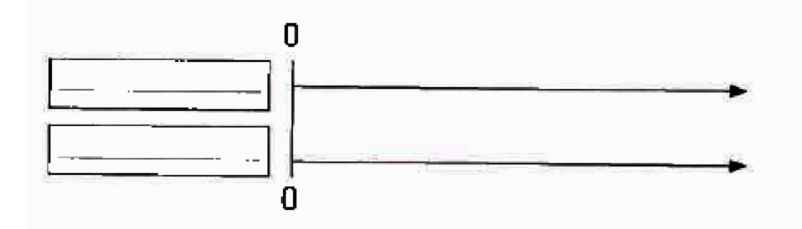

ⓐ 3:4 ⓑ 2:3 ⓒ $\frac{4}{10}$ ⓓ 2:5



**[3]**

- The opposite table shows the covered distance of a cat in meters and the time taken in seconds.

Represent this data by double number line.




| Distance in meters | Time In seconds |
|---|---|
| 2 | 6 |
| 4 | 12 |
| 5 | 15 |
| 6 | 18 |



**[4]**

The ratio between the numbers of red flowers to yellow is 7 : 4.

If there are 9 more red flowers than yellow, how many total number of flowers ?

..........................................................................................................................

..........................................................................................................................



## Lesson (6) Comparing and Analyzing Ratios

### Properties of equivalent ratios:

**(1) if you multiply [or divide] each of the two terms of a ratio by the same non-zero number, then the resultant ratio is equivalent to the first ratio.**

### For example:

a. $\frac{2}{3} = \frac{4}{6}$ (× 2) and $\frac{2}{3} = \frac{10}{15}$ (× 5) then $\frac{2}{3}$ , $\frac{4}{6}$ , $\frac{10}{15}$ are equivalent ratios.

b. $\frac{15}{20} = \frac{3}{4}$ (÷ 5) and $\frac{15}{20} = \frac{30}{40}$ (× 2) then $\frac{15}{20}$ , $\frac{3}{4}$ , $\frac{30}{40}$ are equivalent ratios.

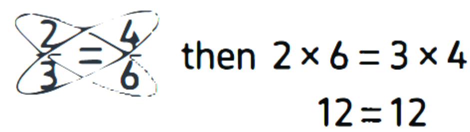
## Cross Multiplication

If $\frac{a}{b} = \frac{c}{d}$ [a and d are called **extrems**, b and c are called **means**]

**Then the product of extrems = the product of means**

$a \times d = b \times c$

**For example:** You know $\frac{2}{3}$ and $\frac{4}{6}$ are equivalent ratios



then $2 \times 6 = 3 \times 4$

$12 = 12$



**(1)** Put each of the following ratios into their simplest forms, then determine whether they are equivalent or not:

ⓐ 3 : 6 , 5 : 10

.......................................

.......................................

.......................................

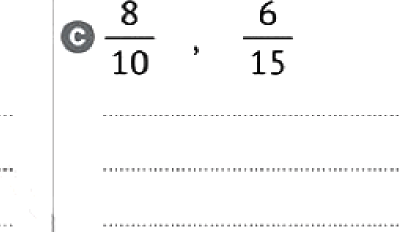
ⓑ $\frac{6}{9}$ , $\frac{7}{14}$

.......................................

.......................................

.......................................

ⓒ $\frac{8}{10}$ , $\frac{6}{15}$



.......................................

.......................................

.......................................

**(2)** Using cross multiplication, determine whether they are equivalent or unequal:

ⓐ 1 : 2 , 3 : 4

.......................................

.......................................

.......................................

ⓑ $\frac{8}{10}$ , $\frac{12}{15}$

.......................................

.......................................

.......................................

ⓒ 2 : 6 , 5 : 15

.......................................

.......................................

.......................................

**(3)** Find the value of $x$ in each of the following:

ⓐ $x : 4 = 2 : 8$

$\frac{x}{2} = \frac{4}{8}$

$x = \frac{2 \times 4}{8} = 1$

ⓑ $4 : x = 2 : 6$

$\frac{\dots}{\dots} = \frac{\dots}{\dots}$

$x = \frac{\dots \times \dots}{\dots} = \dots$

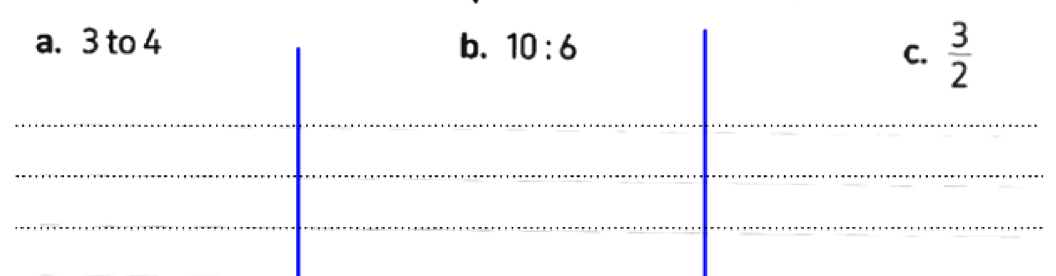
ⓒ $\frac{2}{3} = \frac{x}{9}$

$x = \frac{\dots \times \dots}{\dots} = \dots$

ⓓ $\frac{5}{15} = \frac{2}{x}$

$x = \frac{\dots \times \dots}{\dots} = \dots$

**(4)** What three ratios that are equivalent to each ratio.



a. 3 to 4

b. 10 : 6

c. $\frac{3}{2}$



## (5) Chose the correct answer:

**(1)** Which ratio is equal to 3: 4?

ⓐ $\frac{4}{3}$ ⓑ $\frac{6}{7}$ ⓒ $\frac{9}{12}$ ⓓ $\frac{10}{15}$

**(2)** If $\frac{a}{b} = \frac{c}{d}$. Which of the following is true ?

ⓐ $a \times b = c \times d$ ⓑ $a \times c = b \times d$ ⓒ $a \times d = c \times b$ ⓓ $c \times b = d \times b$

**(3)** Which of the ratios in each pair are equivalent ?

ⓐ $\frac{10}{8}, \frac{15}{12}$ ⓑ $\frac{6}{2}, \frac{8}{2}$ ⓒ $\frac{3}{12}, \frac{4}{1}$

**(4)** $\frac{x+2}{5} = \frac{28}{35}$, then x = ..................

ⓐ 2 ⓑ 4 ⓒ 6 ⓓ 8

**(5)** If $\frac{x}{2} = \frac{8}{x}$, where x is a natural number, then x = ..................

ⓐ 2 ⓑ 4 ⓒ 6 ⓓ 8

**(6)** If $\frac{3}{0.5} = \frac{x}{1}$, then x = ................

ⓐ 2 ⓑ 4 ⓒ 6 ⓓ 8



# Homework

## (1) Complete:

(1) Using cross multiplication, explain whether they are equivalent or not:

ⓐ 20 : 8 , 5 : 2

..............................................
..............................................
..............................................
..............................................

ⓑ 2 : 9 , 12 : 54

..............................................
..............................................
..............................................
..............................................

ⓒ $\frac{2}{5}$ , $\frac{8}{24}$

..............................................
..............................................
..............................................
..............................................

**(2) Find the value of x in each of the following equivalent ratios:**

ⓐ $\frac{5}{8} = \frac{15}{x}$

$x$ = ..............................................

ⓑ $\frac{2}{7} = \frac{x}{35}$

$x$ = ..............................................

**(3) Find the value of x in each of the following equivalent ratios:**

ⓐ $35 : 42 = x : 6$

$x$ = ..............................................

ⓑ $\frac{x}{5} = 3$

$x$ = ..............................................

ⓒ $5 : 8 = 17.5 : x$

$x$ = ..............................................

ⓓ $28 : 49 = x : 35$

$x$ = ..............................................



## (2) Chose the correct answer:

**(1)** Which ratio is equal to 2: 3?

ⓐ $\frac{4}{8}$ ⓑ $\frac{4}{6}$ ⓒ $\frac{6}{4}$ ⓓ $\frac{10}{20}$

**(2)** If $\frac{x}{8} = \frac{3}{4}$, then $x$ = ..................

ⓐ 3 ⓑ 4 ⓒ 5 ⓓ 6

**(3)** If $4 : 7 = x : 35$, then $x - 2$ = ..................

ⓐ 10 ⓑ 12 ⓒ 16 ⓓ 18

**(4)** If $\frac{a}{b} = \frac{c}{d}$, then $a \times d$ = ..................

ⓐ 2d ⓑ cb ⓒ cd ⓓ bd

**(5)** If $\frac{2}{x}$ and $\frac{8}{20}$ are equivalent ratios, then $x$ = ..................

ⓐ 2 ⓑ 4 ⓒ 5 ⓓ 6



3 **Comparing Ratios.** Tarek and Hashem each made a batch of paint in the Paint Mixer. Hashem's batch was in the ratio 6 yellow to 4 red. Tarek wants to have the same color as Hashem, so he used a ratio of 9 yellow to 6 red. **Are their paint batches the same color? Explain how you know.**

.....................................................................................................................

.....................................................................................................................



# Unit (9) Assessment

## (1) Complete:

(1) 10: 12 in the simplest form = ……

(2) $\frac{2}{6} = \frac{3}{\dots} = \frac{\dots}{12} = \frac{5}{\dots} = \frac{\dots}{30}$

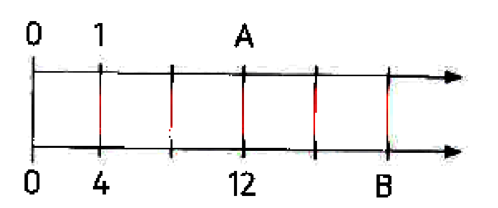
(3) If $\frac{36}{x} = 0.4$, then $x =$ ……………

(4) If $8 : x = 10 : 32$ , then $x =$ ……………

Ahmed needs to study 21 hours to finish his weekly homework, then the rate of his study per day is ……………/hr.

(5) In the opposite double number line,

A = ———— , B = ————




(6) If $\frac{2}{x}$ and $\frac{8}{20}$ are equivalent ratios, then $x =$ ……………

(7) $\frac{2}{x}$ and 8 are two equivalent ratios, then $x =$ ……………

(9) In the opposite tape diagrams. If the number of boys is 20, then the number of girls = ————

| Boys | | | | | | |
|---|---|---|---|---|---|---|
| Girls | | | | | | |



## (2) Chose the correct answer:

**(1)** 25 : 50 = ...........

ⓐ 2: 1   ⓑ 1:2   ⓒ 2:3   ⓓ 3:7

**(2)** Which of the following is equivalent to $\frac{8}{12}$

ⓐ $\frac{2}{5}$   ⓑ $\frac{2}{7}$   ⓒ $\frac{2}{3}$   ⓓ $\frac{3}{2}$

**(3)** From the opposite rectangle :
The ratio between length and perimeter is ______

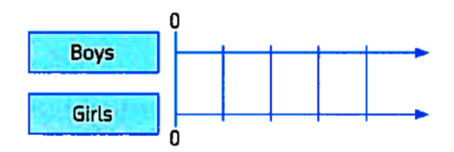
5 cm
10 cm

ⓐ 2:1   ⓑ 4:5   ⓒ 2:3   ⓓ 1:2

**(4)** The ratio between two side lengths of a rhombus is ...................

ⓐ 2:1   ⓑ 1:1   ⓒ 2:3   ⓓ 1:2

**(5)** From the opposite double number line :
If the ratio between the numbers of boys to girls is 5 : 6 and the total of boys and girls is 44 pupils , then the number of girls is ..................




ⓐ 4   ⓑ 6   ⓒ 20   ⓓ 24

**(6)** 55 % ☐ $\frac{2}{5}$

ⓐ $=$   ⓑ $>$   ⓒ $<$   ⓓ $\leq$









UNIT

10

Theme 3 | Fractions, Decimals, and Proportional Relationships: Ratios and Proportional Relationships

# Unit Rates and Percents

# Concept (1): Understand unit rate

## Lesson (1) Exploring Unit Rates

1) The rate is: a ratio that compares two quantities in different units of measure.

2) The unit rate is: a ratio that compares a quantity to one unit of second quantity.



3) Classify the following rates to "unit rates and not unit rates"

A) 240 pounds for 6 tickets. ( ..................................... )

B) 3 liters of petrol per hour. ( ..................................... )

C) 210 km per teacher. ( ..................................... )

D) 2 cups of milk per a cake. ( ..................................... )

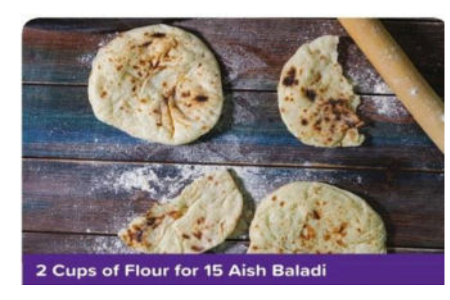
4) How far will the jogger run in 3 hours, if his speed remains the same? .................. Kilometers



6 Kilometers per Hour



5) How much flour would you need to make 20 Aish Baladis?
..................... cups



2 Cups of Flour for 15 Aish Baladi



## Lesson (2) Determining Unit Rates

**1) Which is the fastest?**

Moez run 360 meters in 3 minutes, Kaber run 400 meters in 4 minutes, Bosy run 550 meters in 5 minutes.

A) The unit rate of Moez = ……………… = ………… meter per minutes

By using The tape diagram:

| 120 | 120 | 120 |
|---|---|---|
| 1 | 1 | 1 |

B) The unit rate of Kaber = ……………… = ………… meter per minutes

By using The tape diagram

| 100 | 100 | 100 | 100 |
|---|---|---|---|
| 1 | 1 | 1 | 1 |

C) The unit rate of Bosy = ……………… = …………… meter per minutes

By using The tape diagram

| 110 | 110 | 110 | 110 | 110 |
|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 |

……………… is the fastest



Use ratio table to find the unit rate, then complete.

a. 180 L.E. in 3 days

, then ———— L.E. per day.

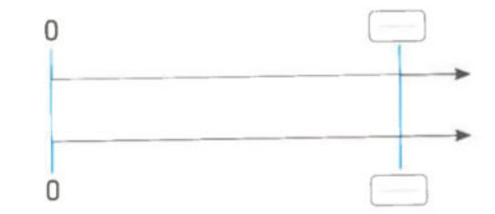
| L.E. | | | |
|---|---|---|---|
| Day | | | |



Use the double number line to find the unit rate, then complete.

a. 12 pupils in 4 benches

, then ———— pupils in each bench.

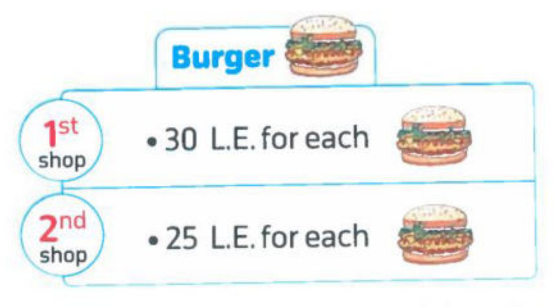





# Lesson (3) Using the Unit Rate

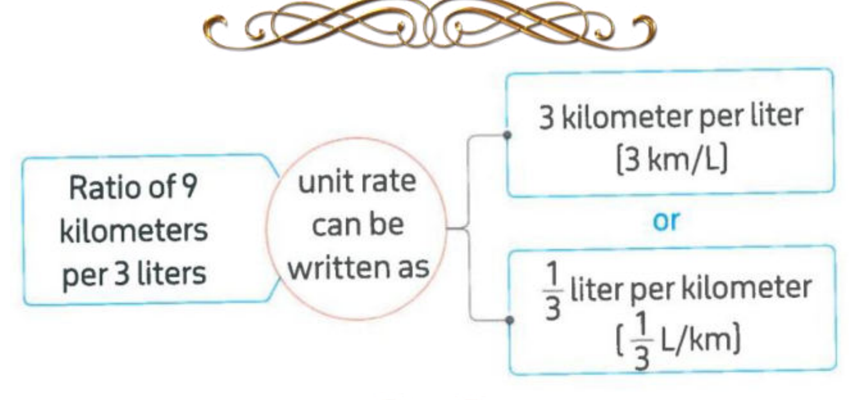
Some of us think that the greater unit rate is better than the smaller one but that not necessary true.

For example : To by some thing from two different shops.




Candy
1st shop — for each 1 L.E.
2nd shop — for each 1 L.E.

The lowest price of sandwich [unit rate] is better. while The greatest amount of candies for each pound [unit rate] is better.






**If 6 cups of flour are needed to make 2 cakes, how many cups of flour are needed to make 5 cakes.**



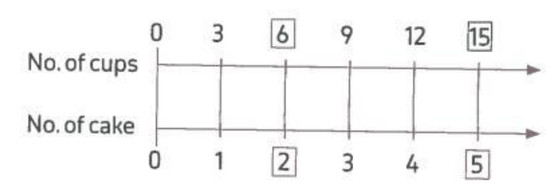
## Solution

- **Using unit rate :**

  Unit rate = $\frac{6 \text{ cups}}{2 \text{ cakes}}$ = 3 cups per cake

  Number of needed cups = 3 × 5 = 15 cups

- **Using double number line :**




So, the number of needed cups = 15 cups

- **Using multiplying and dividing :**

  $\frac{6}{2} = \frac{x}{5}$

  $2x = 6 \times 5$

  $x = \frac{30}{2} = 15$ cups

  So, the number of needed cups = 15 cups

Find the unit rate using the given under each picture.


120 km per 2 hours

a. • ________ km per hour

• ________ hr per km




40 L.E. for 5 kg

b. • ________ L.E. for each kg

• ________ kg for each L.E.




25 cups of flour to make 50 loaves of bread

c. • ________ cup per loaf

• ________ loaf per cup




## [1] Choose the correct answer:

(1) If 4 cups of flour make 2 cakes then .......... of cups of flour makes 8 cakes

ⓐ 2 ⓑ 4 ⓒ 16 ⓓ 32

(2) If car cover a distance of 54 km in 9 hours , its unit rate Is ..........per hour

ⓐ 5 ⓑ 6 ⓒ 8 ⓓ 10

(3) The price of 7 pizza , if the price of each pizza is 10 pounds is...

ⓐ 14 ⓑ 21 ⓒ 70 ⓓ 700

(4) If 30 L.E for 6 kg , then the cost of 30 kg is ....... LE

ⓐ 6 ⓑ 150 ⓒ 24 ⓓ 120



Find the unit rate using the given under each picture.

- ............ km per liter
- ............ liter per km


8 liters of petrol to cover 80 km



How many oranges are needed to get 6 cups of orange juice?

................................................................................................

................................................................................................


3 oranges to get 2 cups of juice



How many kilometers can the driver of this car travel with 3 liters of gas?

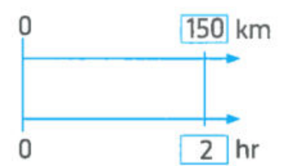
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360 kilometers for Every 12 liters of gasoline

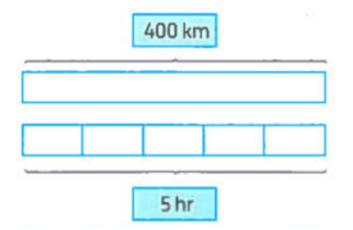


From the opposite double number line, the unit rate is ............






From the opposite tape diagram, the unit rate is ............

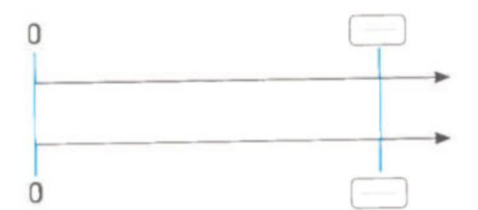





**Use the double number line to find the unit rate, then complete.**

b. 200 L.E. for 4 shirts

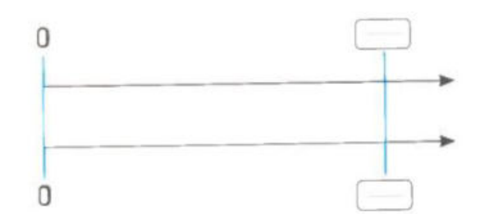
, then ............ L.E. for each shirt.






c. 24 kg of cheese for 8 boxes

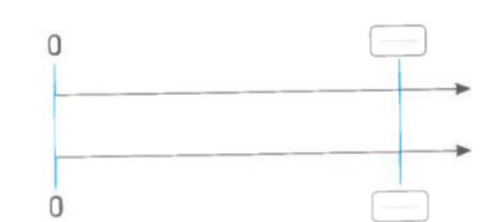
, then ............ kg for each box.






d. 450 km in 3 hours

, then ............ km per hour.






**Use ratio table to find the unit rate, then complete.**

b. 636 pupils in 6 stages

, then ............ pupils in each stage.

| Pupils | | | | | | |
|---|---|---|---|---|---|---|
| Stage | | | | | | |



c. 150 passengers in 5 buses

, then ............ passengers per bus.

| Passengers | | | | | |
|---|---|---|---|---|---|
| Bus | | | | | |



# Concept (2): Convert Measurements with Ratios

## Lesson (4) Exploring Conversion Factor

### Remember some units of measurement :

**Length units :**

- 1 km = 1000 m
- 1 m = 100 cm
- 1 dm = 10 cm
- 1 cm = 10 mm

**Mass units :**

- 1 ton = 1000 kg
- 1 kg = 1000 gm

**Capacity units :**

- 1 liter = 1000 milliliters

**Time units :**

- 1 year = 12 months
- 1 week = 7 days
- 1 day = 24 hours
- 1 hour = 60 minutes
- 1 minute = 60 seconds
- 1 hour = 3600 seconds



**Conversion Factor:** is a ratio between two equal amounts one of them is 1 expressed in different units within the same measurement system.

**Examples:** $\frac{10mm}{1cm}$ , 1 Week : 7 days, 1 hour = 60 minutes



**1) Which of the following represent conversion factor?**

a) 1 km : 1 hour , b) 1m : 1000 mm , c) $\frac{10\,mm}{1\,cm}$

d) 2 cm : 10 mm , e) 100 mm : 1 liter , f) 100 cm : 1 m

| Conversion factor | Not conversion factor |
|---|---|
| | |



**2) Classify which is conversion factor or not conversion factor:**

100 cm in 1 meter, 21 cups = 3 days, 3 m = 3 cm

1000 kg : 1 ton, 2 days = 2000 km, 1 liter = 1000 ml

| Conversion factor | Not conversion factor |
|---|---|
| | |



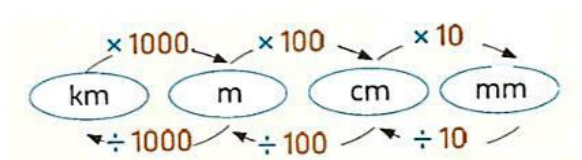
# Lesson (5) Using Conversion Factor

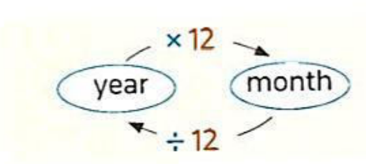
Quantity in the given unit  appropriate conversion factor = Quantity in the required unit

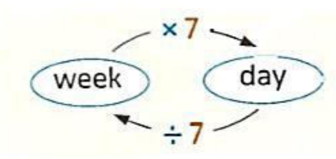
For example :

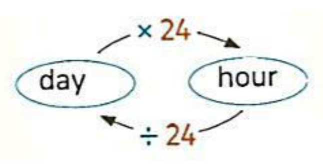
- $3\ \text{hr} \times \frac{60\ \text{min}}{1\ \text{hr}} = 3 \times 60\ \text{min} = 180\ \text{min}$ (60 min: required; 1 hr: Given)
- $12500\ \text{cm} \times \frac{1\ \text{m}}{100\ \text{cm}} = \frac{12500}{100}\ \text{m} = 125\ \text{m}$
- $5632\ \text{gm} \times \frac{1\ \text{kg}}{1000\ \text{gm}} = \frac{5632}{1000}\ \text{kg} = 5.632\ \text{kg}$
- $2.3\ \text{L} \times \frac{1000\ \text{mL}}{\text{L}} = 2.3 \times 1000\ \text{mL} = 2300\ \text{mL}$

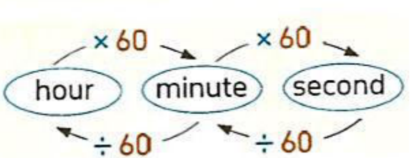


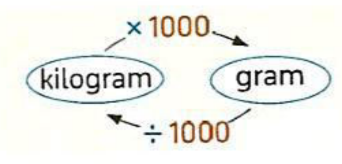


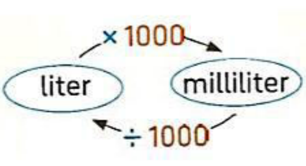




## Complete each of the following:

A) 2 kg = ……… gm.

B) 25 cm = ……. m

C) 15 km = ……. m

D) 4 days = ……… hours

E) 2 weeks = ……. days

F) 3000 ml = …… liters.



**Caracal** Caracals are wild cats found in the deserts of the Middle East, Asia, and Africa. They are known for their leaping abilities and their tufted black ears. Suppose a particular caracal weighs 30.5 kilograms. How many grams does the caracal weigh?

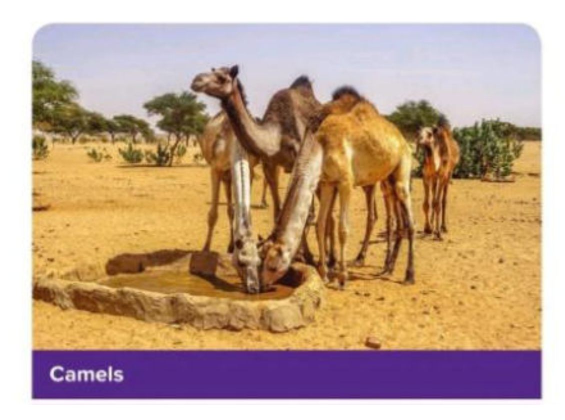
The caracal weighs ________ gm.


Caracal



**Camels** Egypt is home to many camels, which makes sense because camels are well suited for life in the desert. A camel's hump holds a store of fat, and its body temperature can vary up to 10 degrees. On most summer days, camels drink about 20,000 milliliters of water. How many liters of water is that?

Show your calculations.


Camels



## Lesson (6) Applications on the Conversion Factor

**1) To convert a speed from km per hr. into m per hr.:**

$$35\ km\ per\ hr = \frac{35\ km}{1\ hr} \times \frac{1000\ m}{1\ hr} = 35,000\ m\ per\ hr$$



**2) To convert a speed from m per min into km per hr.**

$$8000\ \text{m}\ per\ min = \frac{800\ m}{1\ min} \times \frac{1\ km}{1\ hr} \times \frac{48000\ km}{1000\ hr} = 48\ km\ per\ hr$$



## 3) Complete each of the following:

A) $\dfrac{25km}{1hr} \times \dfrac{\dots\dots\dots}{\dots\dots\dots} = \dfrac{\dots\dots\dots m}{\dots\dots\dots hr}$

B) $\dfrac{60m}{1\text{min}} \times \dfrac{\dots\dots\dots}{\dots\dots\dots} = \dfrac{\dots\dots\dots m}{\dots\dots\dots \text{sec}}$

C) $\dfrac{35m}{1\text{min}} \times \dfrac{\dots\dots\dots}{\dots\dots\dots} \times \dfrac{\dots\dots\dots}{\dots\dots\dots} = \dfrac{\dots\dots\dots km}{\dots\dots\dots\ 1hr}$

D) 3 days = ……… min



## [1] Choose the correct answer:

(1) 1 m : ………… is not a conversion factor

ⓐ 100 cm ⓑ 1000 mm ⓒ 0.001 km ⓓ 60 min

(2) 30 kg = ……..gm

ⓐ 0.03 ⓑ 3000 ⓒ 300 ⓓ 30000

(3) 2.5 liter ……… 2500 ml

ⓐ $<$ ⓑ $>$ ⓒ $=$ ⓓ $\geq$

(4) 1 km …….. 100 m

ⓐ $<$ ⓑ $>$ ⓒ $=$ ⓓ $\leq$

## [2] Complete each of the following:

A) Height of a tree is 3.5 m, then its height in cm = ………

B) A jar of capacity 4500 ml, then its capacity in liter is ……

C) 5.7 liter × ……… = 5700 ml

D) 2 and half a day = ……… Hours



**[3] Which is best to buy? 15 kg per 30 L.E. Or 12.5 L.E. per 5 kg?**



**Write conversion factor or not :**

a. There are 100 cm in 1 m [..........]

b. The ratio of day to hour is 1 : 24 [..........]

c. 100 m = 1 km [..........]

d. $\frac{1}{10}$ cm = 1 mm [..........]





**Complete the following.**

a. 20 m per sec = ........ km per hr

b. 150 m per min = ........ m per hr

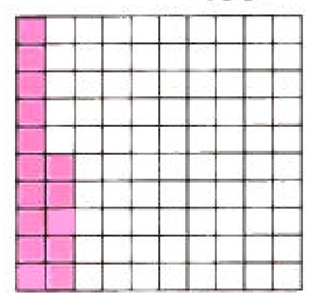
c. 30 km per hr = ........ m per min



# Lesson (7) Exploring percent

## What is percent?

• The ratio $\frac{15}{100}$



• could be expressed as

$$\frac{15}{100} = 15\ \%$$

[ read as 15 percent ]

• so you can say that "15 % of the students of this school are in the 6th grade".



## Describe 100 %, 50 %, 25 %

1. $100\% = \frac{100}{100} = 1$
2. $50\% = \frac{50}{100} = \frac{1}{2}$
3. $25\ \% = \frac{25}{100} = \frac{1}{4}$

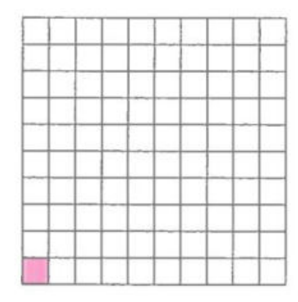


## Comparing to 50%

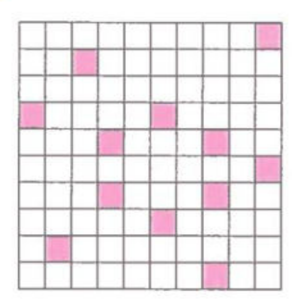
- If 55 % of the dish is full, then **greater than** half of the dish is full.
- If 50 % of the dish is full, then **exactly** half of the dish is full.
- If 45 % of the dish is full, then **less than** half of the dish is full.



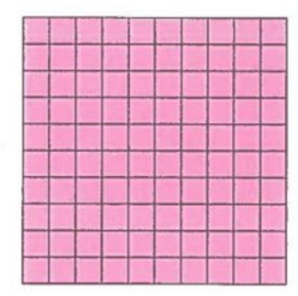
## Some models of percent



one shaded square represents 1 %



12 shaded squares represent 12 %



100 shaded squares represent 100 %



## Converting a decimal into a percent

### Example 1

Convert each of the following decimals into a percentage.

a. 0.3 | b. 0.099 | c. 1.27 | d. 0.625

............................................................

............................................................

............................................................

............................................................

## Converting a fraction into a percent

### Example 2

Convert each of the following fractions into a percentage.

a. $\frac{2}{5}$ | b. $\frac{8}{25}$ | c. $\frac{3}{8}$

............................................................

............................................................

............................................................

## Converting a percent into a fraction

### Example 3

Convert each of the following percentages into a fraction in its simplest form.

a. 27 % | b. 1 % | c. 25 %

d. 12 % | e. $16\frac{2}{3}$ %

............................................................

............................................................

............................................................

............................................................

............................................................

## Converting a percent into a decimal

### Example 4

Convert each of the following percentages into a decimal.

a. 15 %

b. 4.2 %

c. $12\frac{1}{4}$ %

..........................................................................................................................

..........................................................................................................................

..........................................................................................................................

### Example 5

Choose the correct answer from those given.

a. If the percentage of success in a school is 76% , then the percentage of failures is ............ %

A. 24 B. 44 C. 67 D. 90

b. 1 – [15 % + 55 %] = ............ %

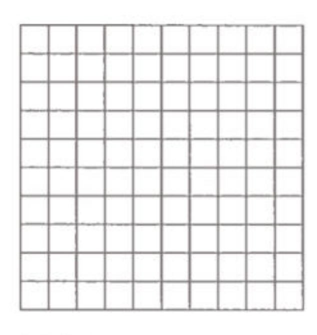
A. 25 B. 29 C. 30 D. 70

c. 90 % – [22 % + 43 %] = ——

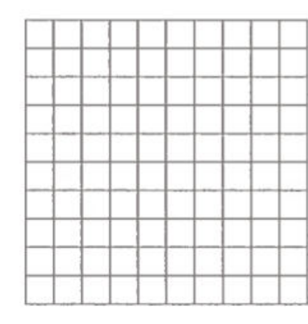
A. $\frac{1}{5}$ B. $\frac{1}{4}$ C. $\frac{1}{2}$ D. $\frac{3}{4}$



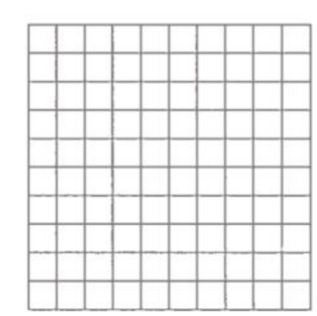
Use 10 × 10 grids to model each percent :



a. 38 %

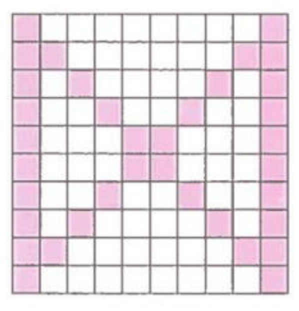


b. 5 %



c. $12\frac{1}{2}$ %

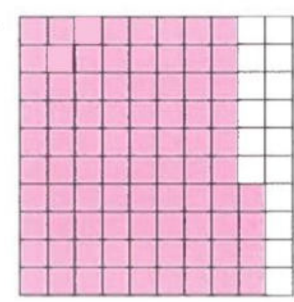
Express each shaded area as a percent, as a fraction in simplest form, and as a decimal :

a. 

percent : ______

fraction : ______

decimal : ______

b. 

percent : ______

fraction : ______

decimal : ______



Write each percent as a fraction in simplest form.

a. 65 %

b. 18 %

c. 34 %

d. 4 %

e. 100 %

f. 140 %

g. 155 %

h. 12.5 %



Find the value of x in each of the following :

a. $\frac{x}{9} = 15\%$

b. $\frac{x}{12} = 36\%$

c. $\frac{2}{x+8} = 5\%$

d. $\frac{x+6}{20} = 50\%$

Rania has 60 L.E. She spent $\frac{3}{5}$ of what she has. What is the percentage of the money she spent ?

..............................................................................

..............................................................................

There are 100 members in a club, half of them above 40 years. What is the percentage of the number of members that above 40 years ?

..............................................................................

..............................................................................



The air we breathe is about 80 % nitrogen and 20 % oxygen. Write each percent as a fraction in simplest form and as a decimal.

............................................................

............................................................

............................................................

| Lesson (8) | Finding the part, the whole and the percent |
| --- | --- |
| Lesson (9) | Using models to find the whole |
| Lesson (10) | Using models to find percentage |

## How to find the part, the whole or the percent ?

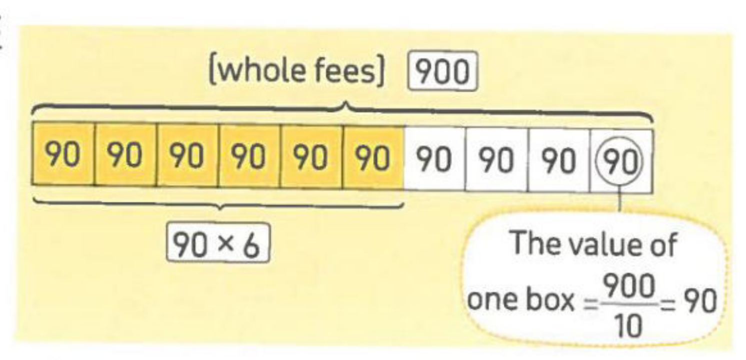
### Example 1

### First : How to find the part ?

The weekly fees of a worker is 900 L.E. , he spends 60% of his fees on food and rent. Find the amount of money that he spends on food and rent.

**1 By using a tape diagram :**

- Draw a tape diagram, divide it into 10 equal boxes.
  «i.e. each box worths 10%»

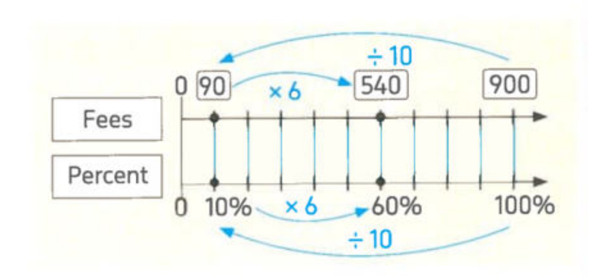



- The whole tape represent the whole quantity
- Find the value of each box = $\frac{900}{10}$ = 90 L.E.
- Find the amount of money that represents 60%
  that represents 6 boxes of the tape = 90 × 6 = 540 L.E.



## 2 By using a double number line :

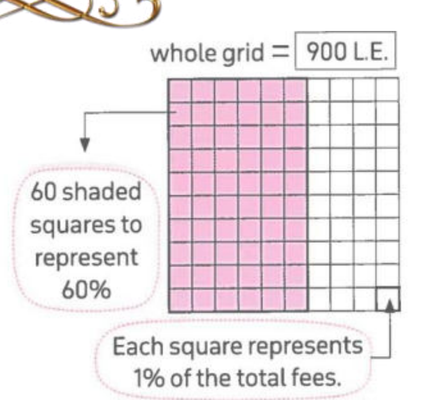
- Draw a double number line, the upper line represents the fees and the lower one represents the percent.
- Find the value of one part [that represents 10%] $= \frac{900}{10} = 90$ L.E.
- Find the amount of money that represents $60\% = 6 \times 90 = 540$ L.E. [because it represents 6 parts of the lower line]






## 3 By using a 10 by 10 grid :

- Draw a grid formed from 10 rows and 10 columns to represent the total fees 900 L.E.
- Find the value of each small square $= \frac{900}{100} = 9$ L.E.
- Find the amount of money that represents 60% «i.e. 60 small square» $= 60 \times 9 = 540$ L.E.






## 4 By using multiplication algorithm :

The part = whole × percent

$= 900 \times 60\% = 900 \times \frac{60}{100} = 540$ L.E.




## Example 2

**A zoo goes through 200 kg of seeds each week.**

**a.** If the doves eat 25% of the quantity of seeds goes through each week find, by using the double number line, how many kilograms do the doves eat weekly ?

**b.** If sparrows eat 13% of the same quantity of seeds find, by using a 10 × 10 grid, how many kilograms do the sparrows eat ?

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If the gorillas eat 30% of the 600 kg of browse the zoo goes through daily. How many kilograms of browse do gorillas eat each day ?

Use the following models :

**a** a tape diagram

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**b** a double number line

0

0

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**c** a $10 \times 10$ grid

whole grid =



## Second : How to find the whole ?

**Example 3**

180 students from the total number of students in a school have pets that represents 30% of the total number of students in the school. What is the total number of students in the school ?

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## Example 4

You are stocking pineapples at the store. You have stocked 48 pineapples, which is 20% of the number of pineapples that you need to stock. Create tape diagram to find the total number of pineapples ?

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If you stored 64 boxes of merchandise which is 40% of the total number of boxes. What is the total number of boxes ?

## Third : How to find the percent ?

## Example 5

Sandy ate 6 oranges from 20 oranges on a plate
What is the percent of the orange Sandy ate ?

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## Example 6

In a train carriage, the number of occupied seats is 42 seats. If the total number of seats of the carriage is 70 seats, calculate by using double number line the percent of the occupied seats.

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A hand mixer costs 400 L.E. There is 80 L.E. discount on it.
What is the discount percentage ?

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______________________________________

______________________________________



Complete each of the following.

**a.** 23% of 300 = ______

**b.** 45 % of 200 = ______

**c.** $6\frac{1}{4}$ % of 400 kg. = ______ kg.

**d.** 12 % of 400 m. = ______ cm.

**e.** 15 % of ______ = 75

**f.** $33\frac{1}{3}$ % of ______ = 20

**g.** 9 % of ______ kg. = 72 kg.

**h.** ______ % of 240 = 60

**i.** ______ % of 600 L.E. = 120 L.E.

**j.** If 25 % of a number = 120 , then this number = ______

**k.** If 200 of the 500 reptiles in a zoo are on display, then the percent of the reptiles are on display = ______

**l.** Youssef has 6 green pencils in his bag. If this is 30% of the total number of pencils, then the number of all pencils in his bag = ______

**m.** Adel have 200 L.E., he spent 45% of his money to buy a book, then the price of this book = ______



95% of students who study physics in a school succeded in the exam. If the number of students in this school is 1200. **Find the number of succeded students?**

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## Lesson (11) Applications on percentage

### How to solve story problems on percentage

**Example 1**

**Use the benchmark 1% and 10% to find each of the following.**

a. 20% of 360

b. 15% of 360

c. 32% of 360

d. $10\frac{1}{2}$% of 360

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## Example 2

A home appliances store gives discounts on some items as the following table.

| Hand mixer | Fridge | Heater | T.V. |
|---|---|---|---|
| 4,200 L.E. | 18,000 L.E. | 7,500 L.E. | 16,400 L.E. |
| 15% | 30% | 41% | 5.5% |

Use the benchmark 1% and 10% to find the value of each discount and the selling price.

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## Example 3

Ahmed bought a fridge , its original price is 21,200 L.E. The sales tax on the fridge is 14%

What is the price of the fridge after adding the tax ?

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## Example 4

The price of a T.V. set is 20,000 L.E. The T.V. is on sale for 15% on a white Friday sale, an extra discount 21% is applied of the reduced price of the T.V.

Find the selling price of the T.V.

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## Example 5

Mona went to have dinner in a restaurant. The subtotal of the bill was 680 L.E. A 10% service charge and 5% taxes charge are added to the bill. Calculate the total sum of the bill. [knowing that the tax and the service each typically calculated using the original bill].

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If a 360 L.E. pair of shorts is on sale for 25% off, what are two different ways you could reason this percentage to determine the amount of savings ?

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How would you reason the price of jeans that cost 500 L.E. If there were another 15% discount applied to the new sale price after the original 40% discount ?

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The Price of a car is 800,000 L.E. The owner give a 10% discount on it but the car has not been sold yet. So he had to give another discount 5% off the reduction price.

**Calculate the selling price of the car after these two reductions.**

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If a man deposited 20, 000 L.E. in a bank with annual interest 15 %

**Find the total amount which he gets at the end of one year.**

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# Unit (10) Assessment

Choose the correct answer.

1. 256 cm = ________ m

A. 25600 B. 25.6 C. 2560 D. 2.56

2. 20% of 40 kg = ________ kg

A. 4 B. 8 C. 12 D. 16

3. $\frac{____}{3600 \text{ sec.}}$ is a conversion factor.

A. 1 min B. 1 sec C. 1 hr. D. 60 min.

4. From the opposite double number line

x = ________

(Double number line: top 0, x, 800; bottom 0, 40%, 100%)

A. 40 B. 400 C. 320 D. 3600

5. Which of the following is NOT conversion factor ?

A. $\frac{60 \text{ min.}}{1 \text{ sec.}}$ B. $\frac{1 \text{ L}}{1000 \text{ mL}}$ C. $\frac{1000 \text{ m}}{1 \text{ km}}$ D. $\frac{1 \text{ day}}{24 \text{ hr.}}$

6. Which of the following is a unit rate ?

A. 60 sec. per min B. 5 kg per 2 liters
C. 1 km per 3 min D. 15 gm per a cup

7. 150 km per 3 hr = ________ km per hr

A. 450 B. 200 C. 250 D. 50



## 2. Complete.

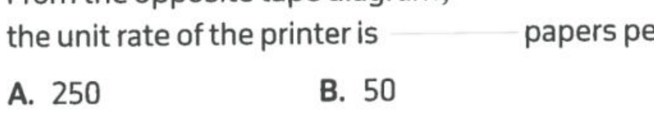
1. 25 L.E. per 5 kg, then the price of each kg = ________ L.E.
2. 15 km per hr = ________ km per min
3. 1 – 25% = ________
4. 200 m × $\frac{___}{___}$ = 0.2 km
5. $\frac{x}{4}$ = 25% , then x = ________
6. 10 L.E. for each kg, then ________ kg per L.E.
7. 5000 km = ________ m
8. A store offer a discount 20% on a shirt of price 400 L.E., then its price after discount = ________ L.E.



## 3. Choose the correct answer.

1. $\frac{1}{8}$ ◯ 8%

   A. >  B. <  C. =



2. From the opposite tape diagram, the unit rate of the printer is ________ papers per min

50 papers

| 1 | 1 | 1 | 1 | 1 |
|---|---|---|---|---|

5 min

   A. 250  B. 50  C. 10  D. 25



3. $1\frac{1}{2}$ = ________ %

   A. 5  B. 150  C. $1\frac{1}{2}$  D. 1500

4. 20 cups of flour to make 5 pizza, then ________ pizza per cup of flour.

   A. 100  B. 4  C. $\frac{1}{5}$  D. $\frac{1}{4}$

5. To convert from hr. to min. the conversion factor is ________

   A. $\frac{1 \text{ hr.}}{60 \text{ min.}}$  B. $\frac{60 \text{ hr.}}{1 \text{ min.}}$  C. $\frac{60 \text{ min.}}{1 \text{ hr.}}$  D. $\frac{1 \text{ min.}}{60 \text{ hr.}}$

6. 20% of pupils in the class = 5 pupils, then the total number of pupils in the class = ________

   A. 20  B. 50  C. 100  D. 25

7. ________ gm = 20 kg

   A. 0.02  B. 2000  C. 200  D. 20000



## 4. Answer the following questions.

1. A speed of a car is 2500 cm per sec. convert its speed to km per hr.

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2. Which is best buy ? • 15 kg per 30 L.E. • 12.5 L.E. per 5 kg

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________________________________

3. Which is the longest. 2.35 km or 965 cm ?

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4. On the sale, a shop offers a discount 15%, if the price of an article is 1600 L.E. Find the price after discount.

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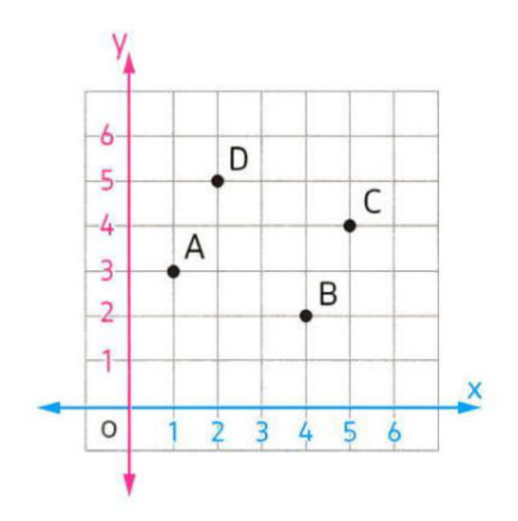
UNIT 11

Theme 4 | Applications of Geometry and Measurement

# Coordinate Plane

# Concept (1): Understand the Coordinate Plane

## Lesson (1) Exploring the Coordinate Plane




Give the coordinates of each point.

- A( , ) • B( , )
- C( , ) • D( , )



In the following coordinate plane, observe and answer.

a. What is the name of each of the following points ?

1. (0 , 8) 2. (9 , 6)
3. (6 , 0) 4. (2 , 3)
5. (1 , 0) 6. (7 , 9)
7. (4 , 5) 8. (2 , 9)
9. (9 , 0) 10. (0 , 0)



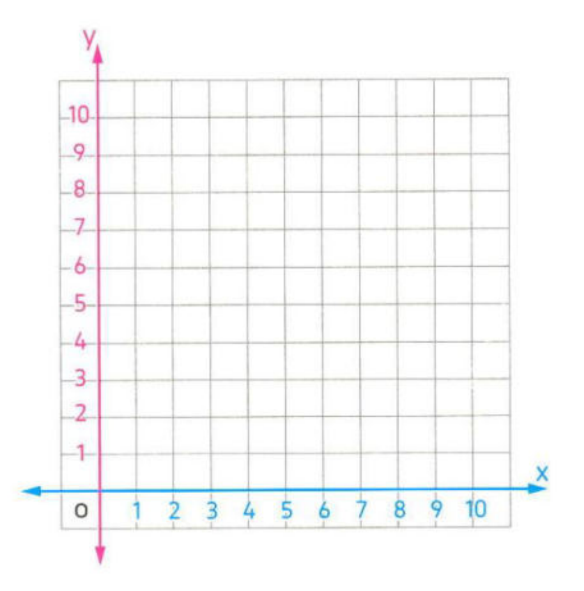
b. Write the ordered pair of each of the following points.

1. W ______ 2. Y ______ 3. N ______
4. F ______ 5. C ______ 6. X ______
7. K ______ 8. U ______ 9. I ______



Plot each point on the coordinate plane.

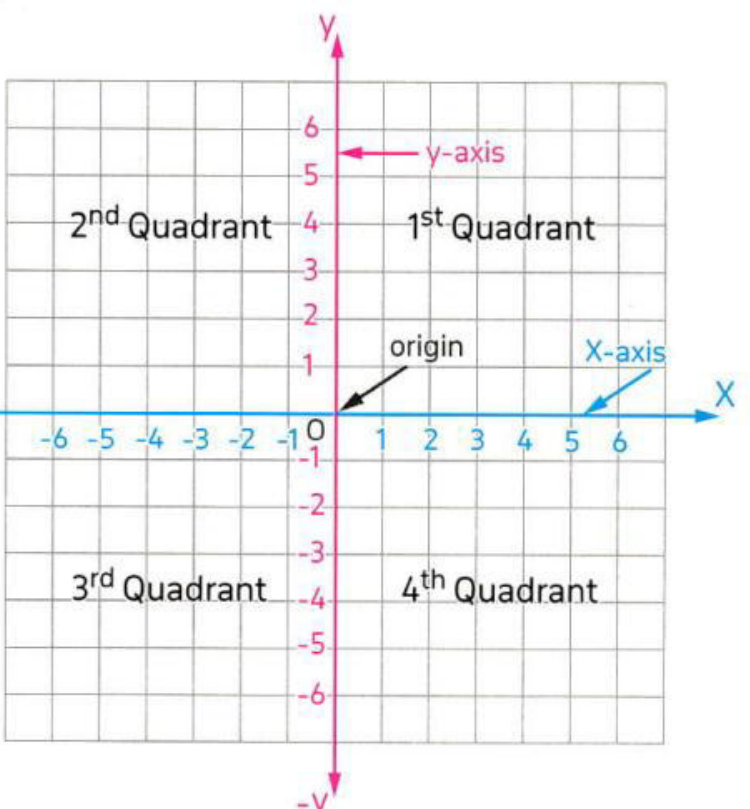
1. T (3 , 3)
2. S (1 , 8)
3. H (2 , 8)
4. E (6 , 2)
5. R (5 , 4)
6. L (7 , 6)
7. M (3 , 1)
8. V (9 , 5)
9. P (7 , 1)
10. A (4 , 7)




## Lesson (2) Analyzing the Coordinate Plane

### • The coordinate plane

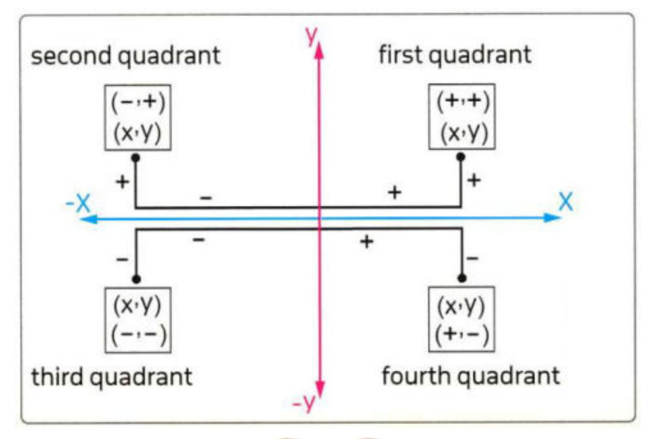
- The coordinate plane is a plane containing a horizontal number line, the x-axis , and a vertical number line , the y-axis.
- The intersection point of these axes is called the origin "O"
- The axes divide the coordinate plane into four parts called "quadrants", which are 1st , 2nd , 3rd , 4th quadrant.







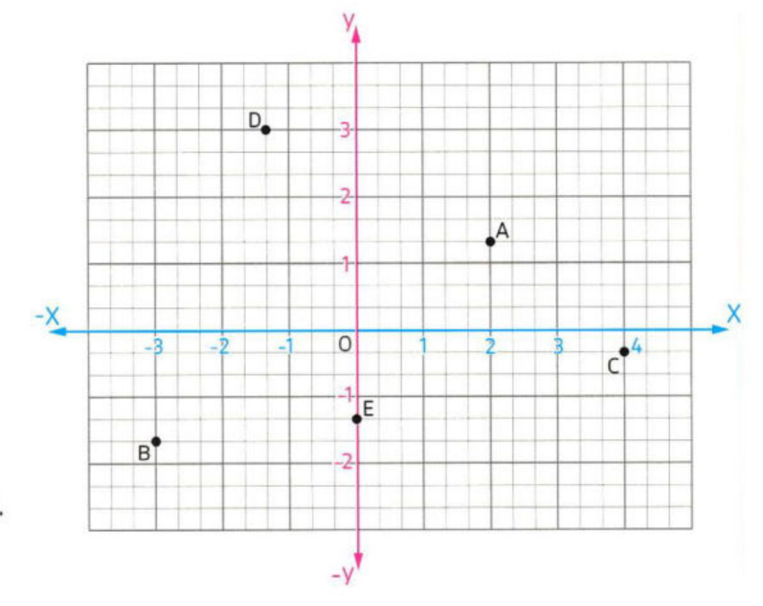





**In the opposite coordinate plane :**

Write the coordinates of each point, and state the quadrant in which each point lies or the axis on which the point lies.



- **A** $(2, 1\frac{1}{3})$, lies in the first quadrant.
- **B** $(-3, -1\frac{2}{3})$, lies in the third quadrant.
- **C** $(4, -\frac{1}{3})$, lies in the fourth quadrant.
- **D** $(-1\frac{1}{3}, 3)$, lies in the second quadrant.
- **E** $(0, -1\frac{1}{3})$, lies on the y-axis.

## Lesson (3) Analyzing Points on the Coordinate Plane

**Use the graph to answer the question.**

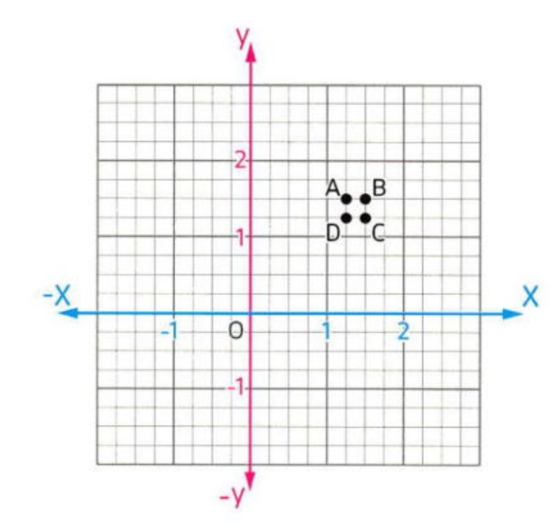
Which point is located at $(1\frac{1}{2}, 1\frac{1}{4})$ ?

A

B

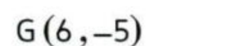
C

D



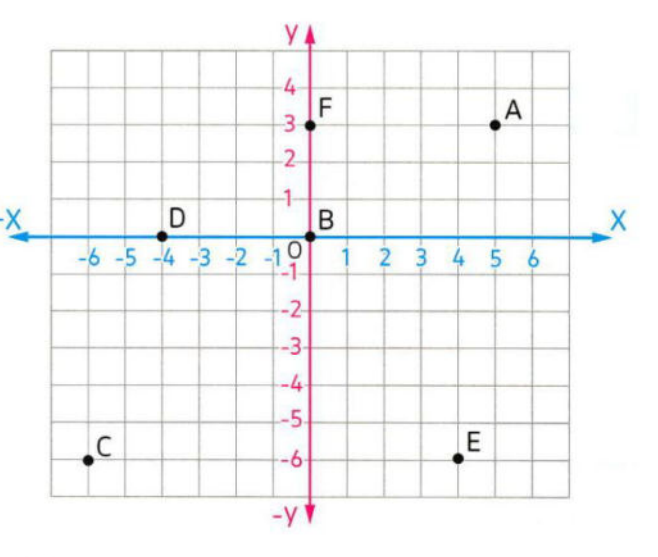


a. For each point on this graph, identify its coordinates.

A  (5 , 3)   B ______

C ______   D ______

E ______   F ______




b. Plot each point on the same graph.

G (6 , –5)   H (–4 , 2)

I (0 , –3)   J (4 , –4)

K (–2 , –3)   L (3 , 0)



Write the ordered pair that corresponds to the points.

A ______

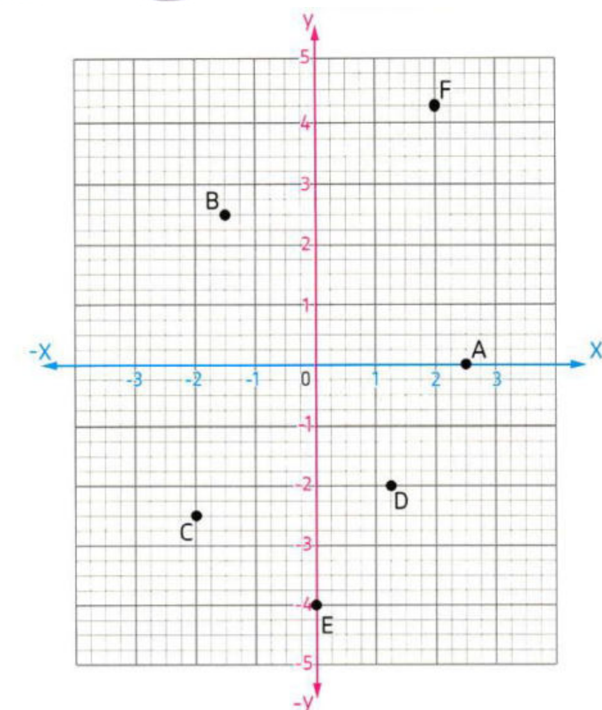
B ______

C ______

D ______

E ______

F ______






## Reflection Across the y-axis

The image of any point (x , y) by reflection across the y-axis is the point (–x , y)



## Reflection Across the x-axis

The image of any point (x , y) by reflection across the x-axis is the point (x , –y)

Write the coordinates of the image of each of the following points by reflection across.

First : The x-axis     Second : The y-axis

A (3 , –4)     B (0 , 5)     C (–2 , 6)     D (–4 , 0)     E (–6 , –1)

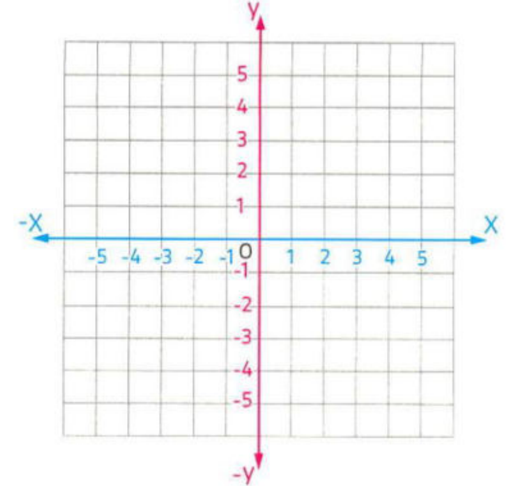


Graph each point.

Then reflect the point in the x-axis.

Record the coordinates of the image.

- A (1, 3)   Image : ..................
- B (– 2 , – 2)   Image : ..................
- C (– 4 , 5)   Image : ..................
- D (2 , – 5)   Image : ..................






## Homework

In which quadrant or on which axis each of the following points lies ?

a. (–3 , 5)     b. (4 , –1)     c. (2 , 0)

d. (2 , 2)     e. (–3 , –6)     f. (0 , –4)



Write the ordered pair that corresponds to the points :

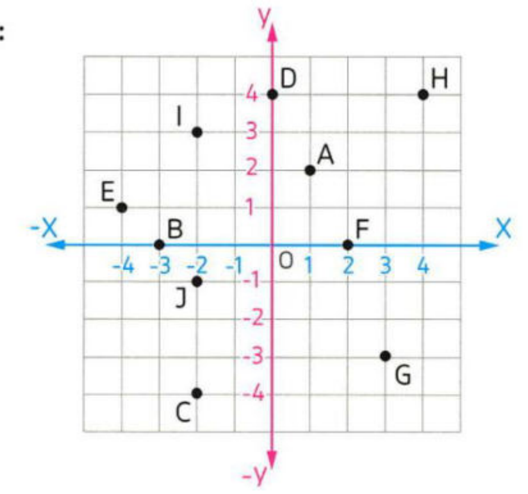
A ..................   B ..................

C ..................   D ..................

E ..................   F ..................

G ..................   H ..................

I ..................   J ..................






**In the opposite coordinate plane.**

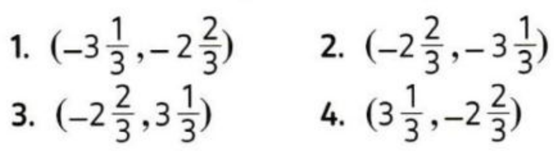
**a.** What are the coordinates for points A

B

D

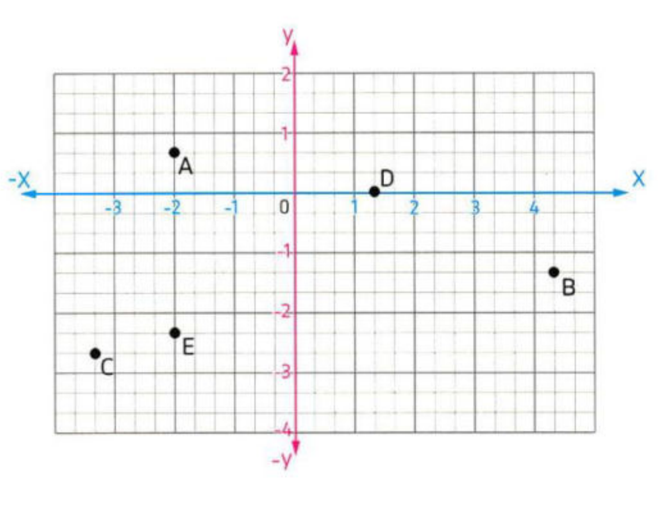
E

**b.** Which ordered pair best represents the location of the object found at point C ?



1. $(-3\frac{1}{3}, -2\frac{2}{3})$ 2. $(-2\frac{2}{3}, -3\frac{1}{3})$

3. $(-2\frac{2}{3}, 3\frac{1}{3})$ 4. $(3\frac{1}{3}, -2\frac{2}{3})$






**First :** Plot the points listed on a coordinate plane.

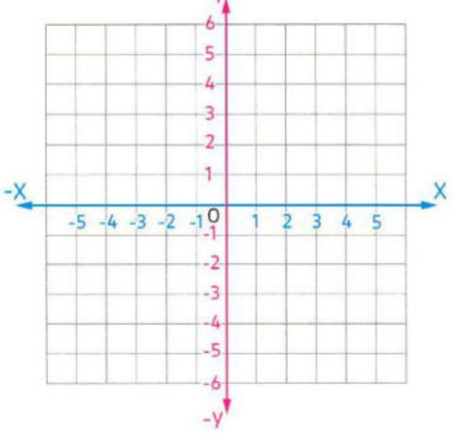
**A** $(-3, 0)$ **B** $(0, -3)$ **C** $(-2, -3)$

**D** $(2, -3)$ **E** $(-2, 3)$ **F** $(2, 3)$

**G** $(5, 5)$ **H** $(-6, -6)$ **I** $(0, 0)$

**Second :** Which point(s) are plotted on the y-axis?

______________________________



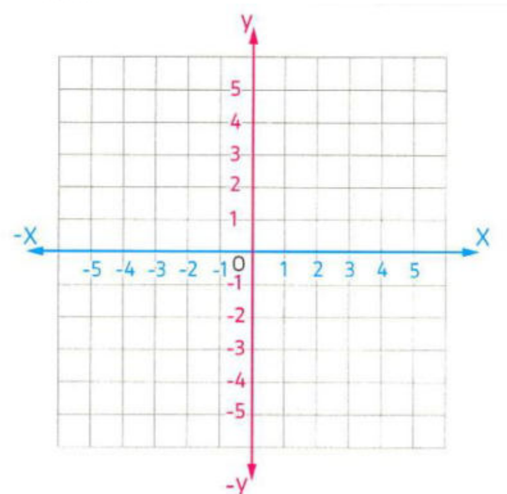



**Graph each point.**

**Then reflect the point in the y-axis.**

**Record the coordinates of the image.**

- A $(1, 3)$ Image : ____________
- B $(-2, -2)$ Image : ____________
- C $(-4, 5)$ Image : ____________
- D $(2, -5)$ Image : ____________






# Concept (2): Use Coordinate Geometry

## Lesson (4) Exploring the Distance between Points on a Line

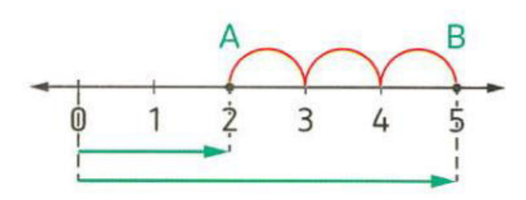
If a , b are on the **same** side of the origin O then :

The distance between A , B $= |a| - |b|$ where $|a| > |b|$

**In the opposite figure :**

The distance between two points A , B

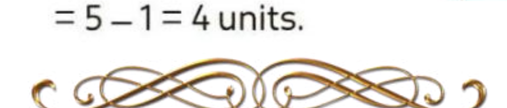

$= |5| - |2| = 5 - 2 = 3$ units.




**In the opposite figure :**

The distance between A , B $= |-5| - |-1|$

$= 5 - 1 = 4$ units.



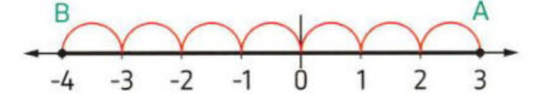
If a , b are on two different sides of the origin O (have different signs) then :

The distance between A , B $= |a| + |b|$ where a is positive and b is negative.

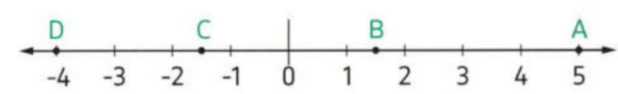
**In the opposite figure :**

The distance between A and B $= |3| + |-4|$

$= 3 + 4 = 7$ units.




**In the opposite figure, find :**




1. The distance between A and B. ..................................................

2. The distance between C and D. ..................................................

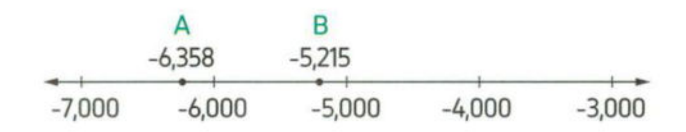
3. The distance between A and D. ..................................................

4. The distance between B and C. ..................................................



In the given figure :

Find the distance between the two points A and B.






## Lesson (5) Exploring Distance between Points on a Coordinate Plane

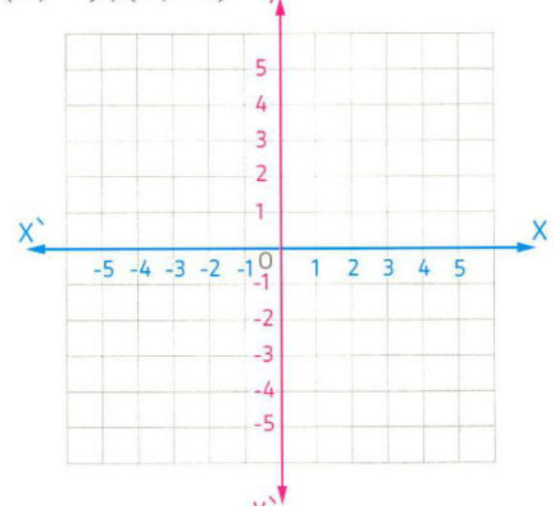
Find the distance between each pair of points of the following :

1. $(-3, 1)$ and $(2, 1)$ ______
2. $(-3, 3)$ and $(-3, 1)$ ______
3. $(2, 1)$ and $(2, -4)$ ______
4. $(4, -4)$ and $(0, -4)$ ______



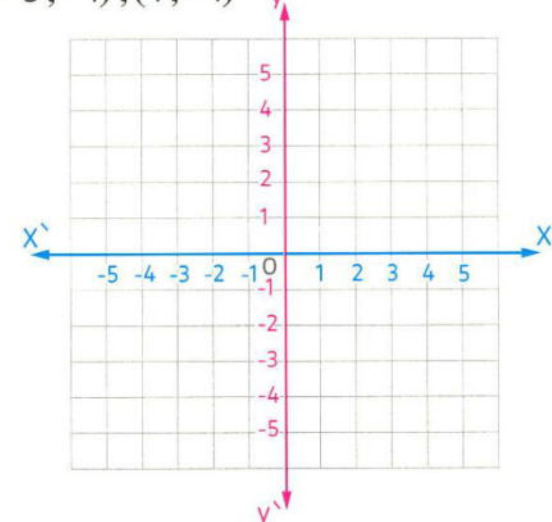
Plot each set of ordered pairs. Join the points and find the length of the resulted line segment.

a. $(4, -1), (4, -5)$




Length of the line segment = ______

b. $(-5, -1), (4, -1)$




Length of the line segment = ______

Find the distance between the points.

a. (– 2 , – 2) and (– 2 , 4)

b. (4 , – 1) and (4 , 5)

c. (– 4 , 1) and (– 3 , 1)

d. (5 , – 2) and (– 2 , – 2)

e. (3 , 0) and (5 , 0)

f. (– 25 , – 5) and (– 25 , – 1)



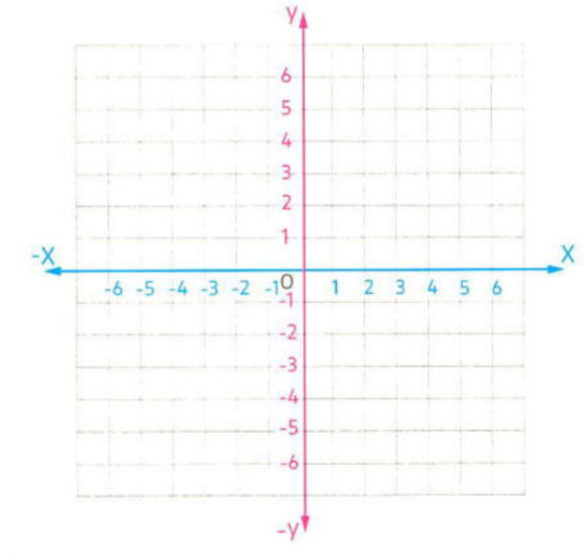
## Lesson (6) Create Geometric Shapes in the Coordinate Plane

Graph the points A (1 , 1), B (5 , 1), C (5 , 4)

What must be the coordinates of point

D if ABCD is a rectangle ?

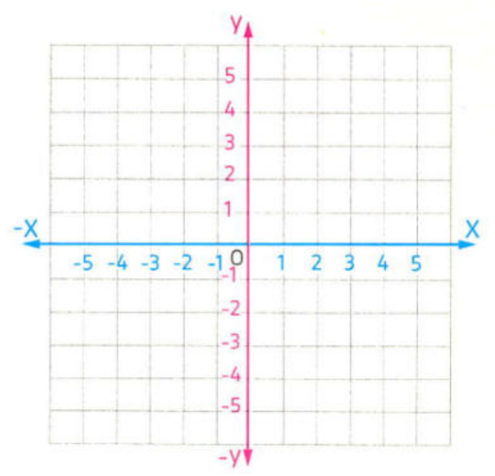
D (   ,   )





Do the points A (2 , 1), B (2 , 5) and C (5 , 1)

represent vertices of a right angled triangle ?



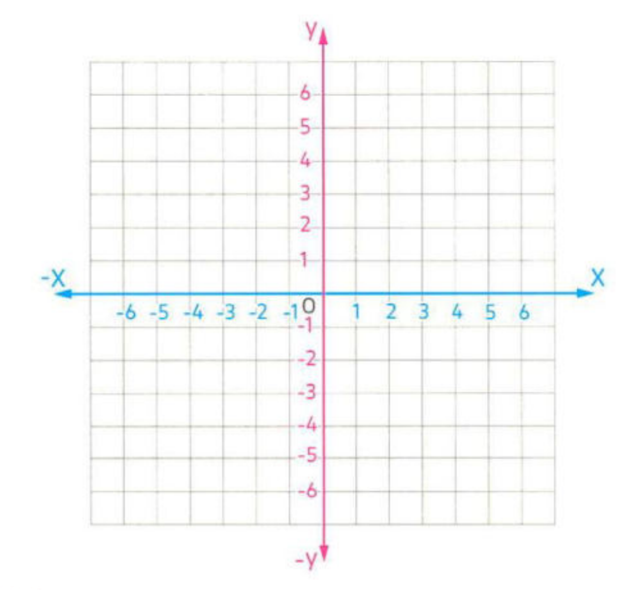






a. Graph and connect the given points : A $(-1,3)$, B $(5,3)$, C $(5,-2)$ and D $(-2,-2)$.

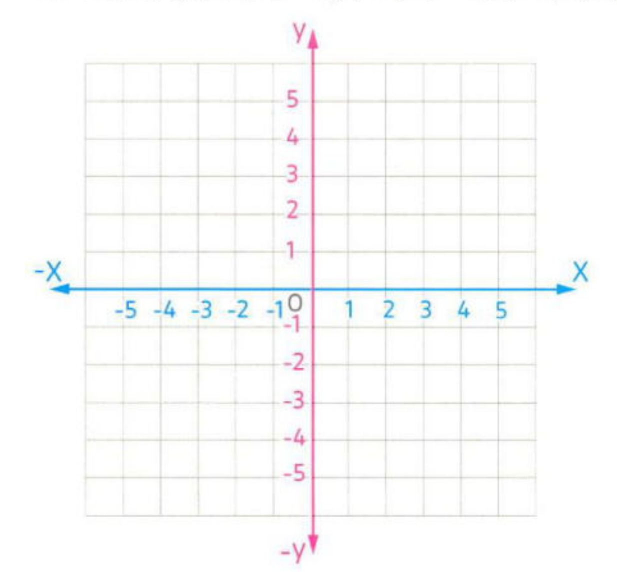
b. Identify the shape.





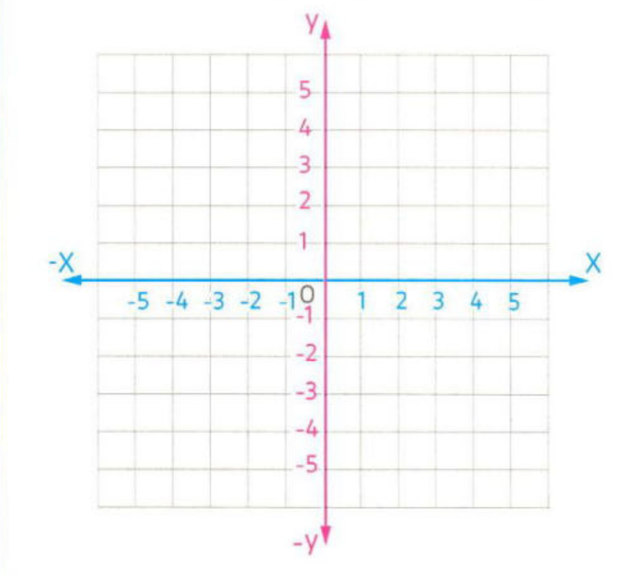
Plot and join the points in the given order. Complete the figure by joining the end points. Identify the shape.

a. A $(5,3)$, B $(5,-3)$, C $(2,-3)$, D $(2,3)$



Shape : ____________

b. E $(1,2)$, F $(1,-2)$, G $(-3,-2)$



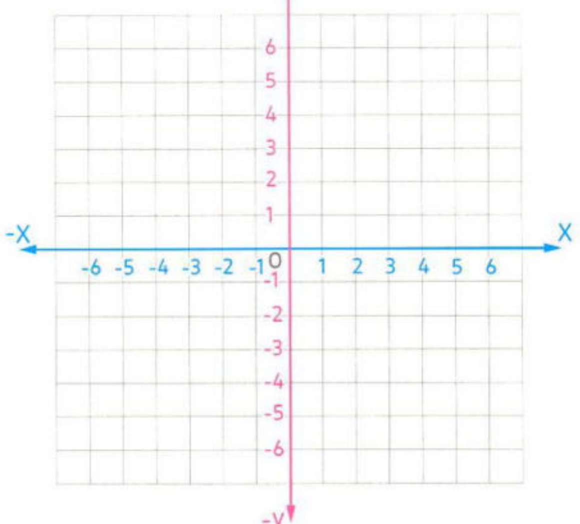
Shape : ____________



The point $(-3, -2)$ is one vertex of a rectangle with a length of 6 units and a width of 1 unit. Using graph paper, plot 3 additional points to complete the rectangle.

Demonstrate your understanding by drawing.

Write the coordinates of the vertices of the 3 other points you plotted to complete the rectangle you just created using graph paper.

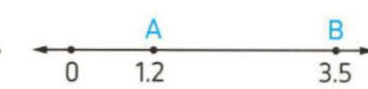






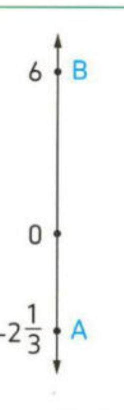
**Find the distance between the two points A and B in each of the following figures.**

a. 


b. 


c. 


d. 


e. 


f. 

Find the distance between each pair of points of the following :

1. A (– 5 , – 1) , B (4 , – 1) ______________________

2. A (4 , – 1) , B (4 , – 5) ______________________

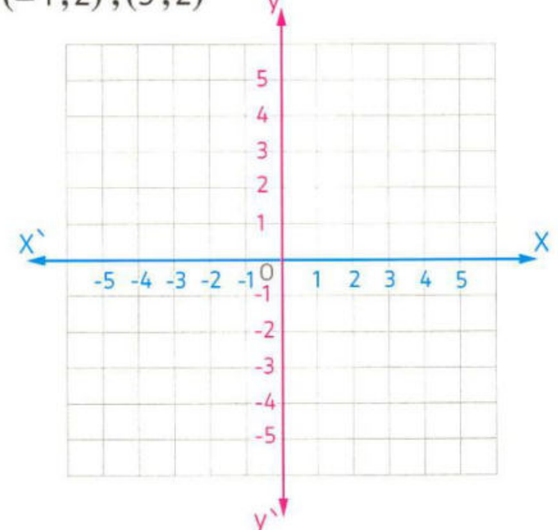
3. A (0 , 3) , B (– 4 , 3) ______________________

4. A (– 3 , 2) , B (– 3 , – 8) ______________________



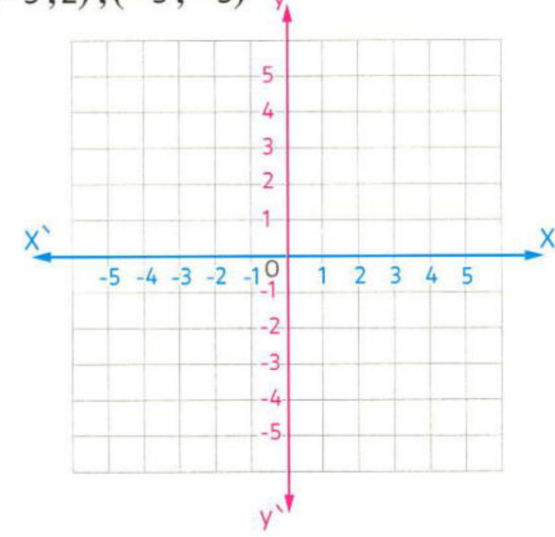
Plot each set of ordered pairs. Join the points and find the length of the resulted line segment.

a. (– 1 , 2) , (5 , 2)




Length of the line segment = __________

b. (– 3 , 2) , (– 3 , – 5)



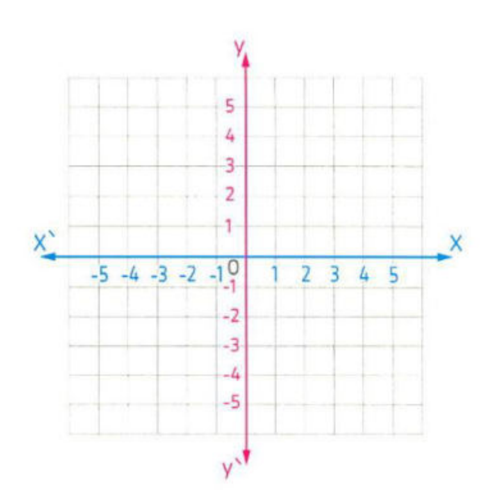

Length of the line segment = __________



Plot and label the points on these grids, then find the distance between them.

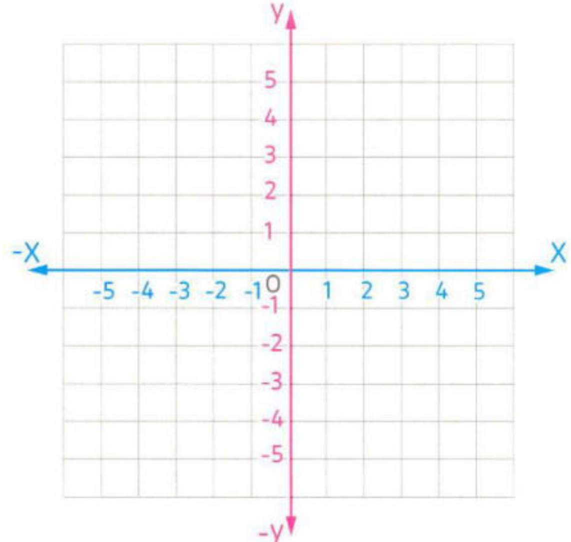
a.

1. (0 , 5) and (0 , – 5) __________
2. (1 , 1) and (1 , – 3) __________
3. (– 2 , – 5) and (– 2 , – 1) __________



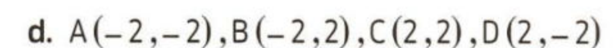
Plot and join the points in the given order. Complete the figure by joining the end points. Identify the shape.

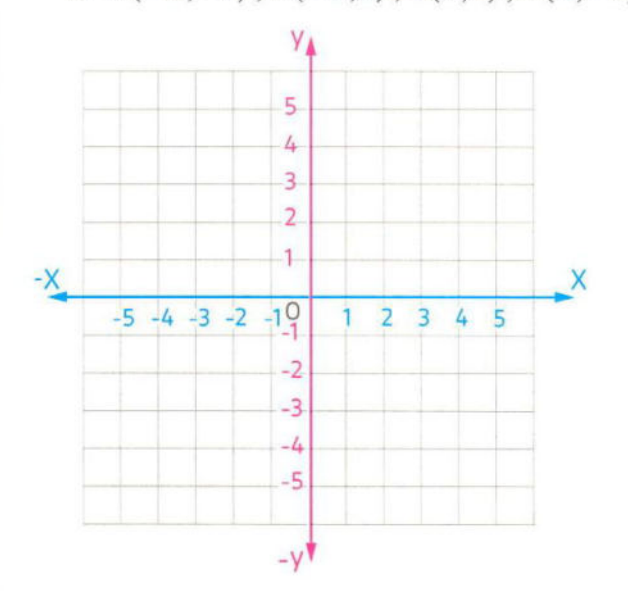
c. I(−2, −1), J(1, −1), K(1, −4), L(−2, −4)



Shape : ____________

d. A(−2, −2), B(−2, 2), C(2, 2), D(2, −2)



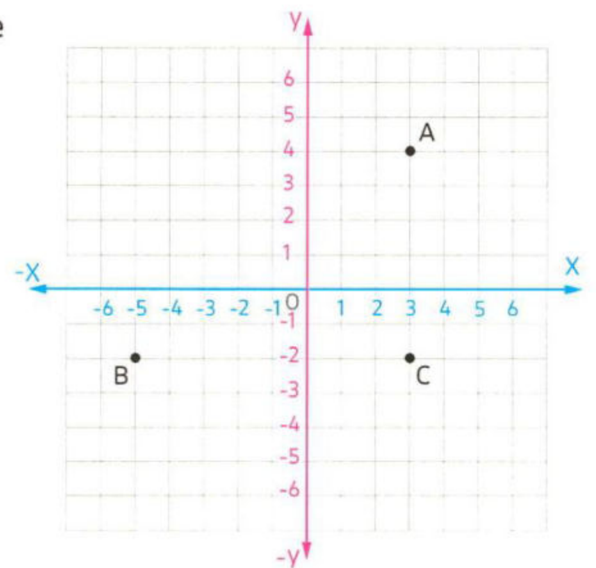


Shape : ____________



**Write** the ordered pair for each of the opposite points graphed and name its quadrant.

- A(____ , ____) lies in ____________ quadrant.
- B(____ , ____) lies in ____________ quadrant.
- C(____ , ____) lies in ____________ quadrant.






**Find the distance between the points.**

a. (3.124 , 0) and (5.876 , 0)

____________

b. (4.56 , −1.89) and (4.56 , 5.543)

____________

c. (−4.008 , 1.34) and (−2.87 , 1.34)

____________

d. (6.9 , −212) and (−3.901 , −212)

____________

e. $(-234, 45\frac{3}{7})$ and $(-234, -4\frac{5}{7})$

____________

f. $(-25, -5\frac{23}{45})$ and $(-25, -7\frac{4}{9})$

____________

## Choose the correct answer.

1. If the two points A (1 , 2) and B (5 , 4) are two vertices of a right-angled triangle ABC, then the point C could be ..........

   A. (1 , 4)  B. (1 , 3)  C. (3 , 1)  D. (4 , 1)

---

2. If the point (4 , 1) is one of the vertices of a square, its side length is 4 units, then the other vertices of the square could be ..........

   A. (4 , – 2), (1 , 4), (1 , – 2)  B. (0 , 1), (0 , – 3), (4 , – 3)

   C. (2 , 1), (2 , – 1), (4 , – 1)  D. (4 , 4), (0 , 4), (0 , 1)

---

3. If A (1 , – 1) and B (4 , – 1) are two vertices of a rectangle, its side length 5 units then the other two vertices are ..........

   A. (4 , – 3), (1 , – 3)  B. (4 , 5), (1 , 5)  C. (4 , 4), (1 , 4)  D. (4 , – 4), (1 , – 4)

---

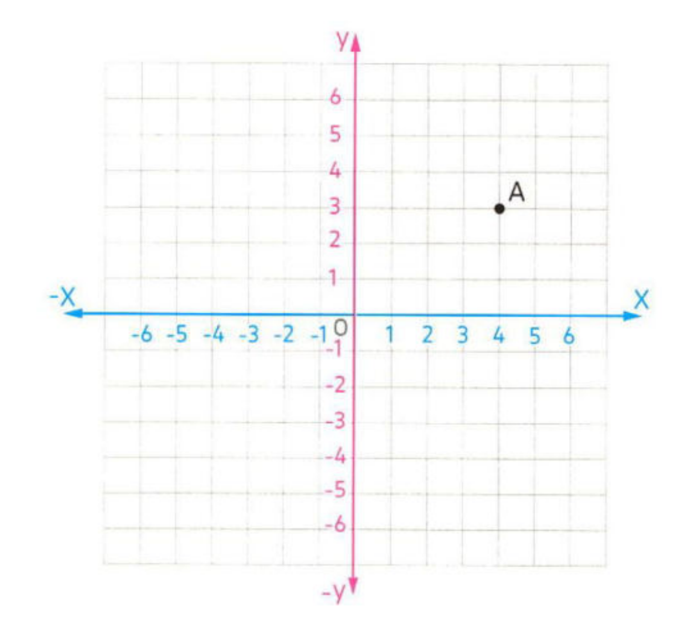
4. If A (1 , 3) and C (4 , 1) and $\overline{AB} \perp \overline{BC}$, then the point B is ..........

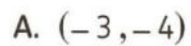
   A. (1 , 4)  B. (3 , 1)  C. (4 , 2)  D. (1 , 1)

---

5. **In the opposite figure :**

   If B is the image of A by reflection in the x-axis and D is the image of A by reflection in the y-axis, then the coordinates of the point C such that ABCD is a rectangle are ..........



   A. (– 3 , – 4)

   B. (– 4 , – 3)

   C. (4 , – 3)

   D. (3 , – 4)



# Unit (11) Assessment

## [1] Choose the correct answer:

(1) The point (-2 , 3) lies in the …… quadrant.

ⓐ first ⓑ second ⓒ third ⓓ fourth

(2) The points (1 , -1) , (2 , -2) , (4 , -5) (-3 , -4) ………

ⓐ lie in the second quadrant ⓒ lie in the third quadrant

ⓑ lie in the fourth quadrant ⓓ Don't lie in the same quadrant

(3) Which point is a reflection of (12 , -8) across the y-axis ?

ⓐ (-12 , -8) ⓑ (8 , 12) ⓒ (-8 , 12) ⓓ (12 , 8)

(4) The image of the point (-3 , -5) by a reflection across the x-axis is ……….

ⓐ (3 , -5) ⓑ (-3 , -5) ⓒ (-3 , 5) ⓓ (3 , 5)



## [2] Complete:

(a) If the two points (-2 , 2) and (3 , a) are on the same straight line, then a = ……

(b) The image of (-4 , 1) by reflection in the y-axis is …………

(c) If the point (1 , -3) is the image of (a , b) by reflection in x-axis, then a + b = …

(d) The distance between the point (0 , -4) and the origin = ………… units.

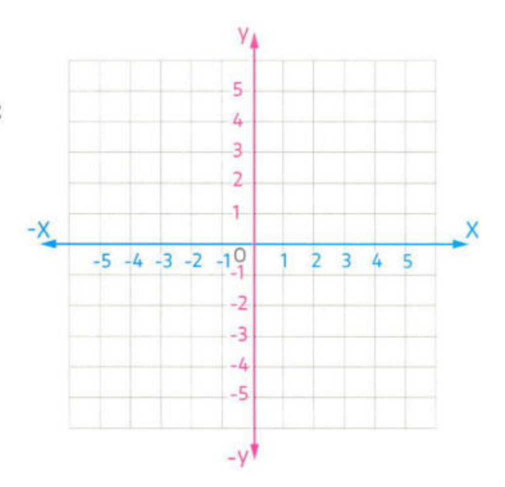


## [3] Answer the following questions:

a. Plot the following points on the opposite grid :
A (3 , 2) , B (– 3 , 2) , C (– 3 , – 2) and D (3 , – 2)

b. Now, connect them.

c. Identify the shape.












UNIT 12

Theme 4 | Applications of Geometry and Measurement

# Area of Some Polygons

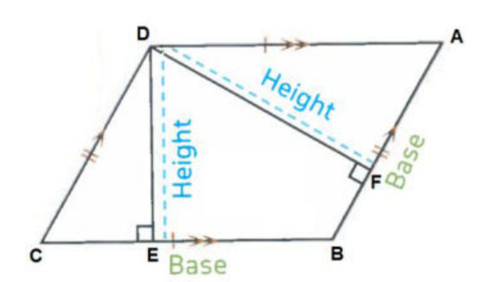



# Concept (1): Find Area of Parallelogram, Triangle, and Trapezium

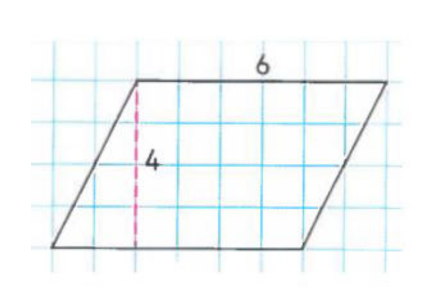
## Lesson (1) Area of Parallelogram

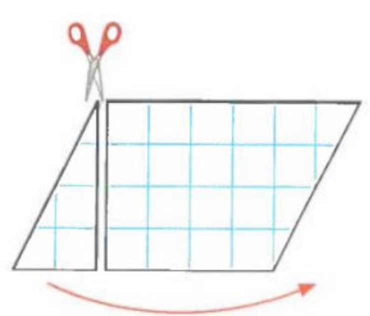
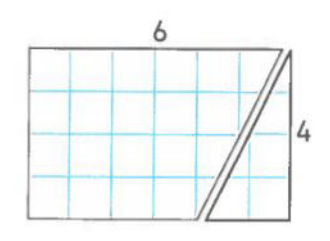
ABCD is a Parallelogram.

- $\overline{DF} \perp \overline{BC}$ , $\overline{DE} \perp \overline{AB}$
- $\overline{AB} // \overline{CD}$ and $\overline{AD} // \overline{BC}$.
- $AB = CD$ and $AD = BC$.
- The greater height $(\overline{DF})$ is corresponding to the smaller base $(\overline{AB})$.
- The smaller height $(\overline{DE})$ is corresponding to the greater base $(\overline{BC})$.





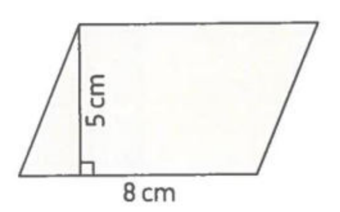

## Rule

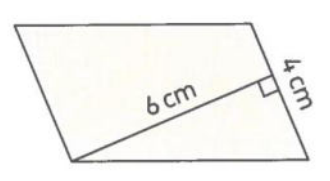
The area of the parallelogram = the base length × the corresponding height

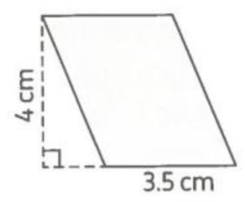
$$A = b \times h$$



**[1] Find the area of each parallelogram:**

a.



b.



c.


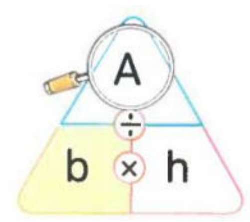

a. ..........................................................................................

b. ..........................................................................................

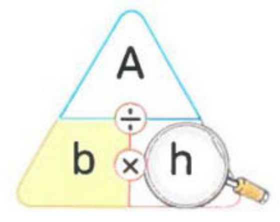
c. ..........................................................................................



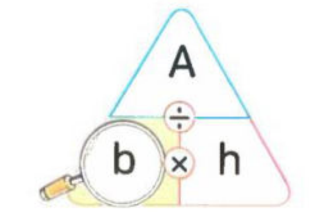
## Remarks




$A = b \times h$




$h = \frac{A}{b}$

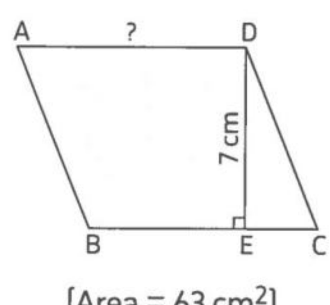



$b = \frac{A}{h}$



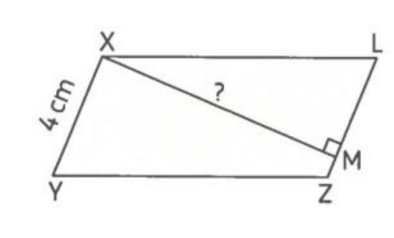
## [2] Find the missing side length in each parallelogram:

a.



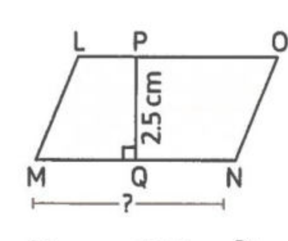

[Area = 63 cm²]

b.




[Area = 32 cm²]

c.




[Area = 12.5 cm²]

a. ..........................................................................................

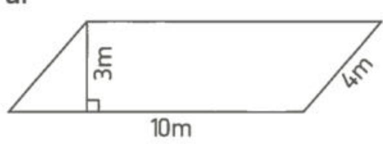
b. ..........................................................................................

c. ..........................................................................................

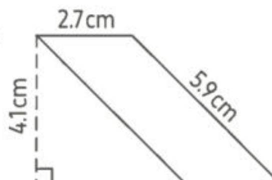


## [3] Find the area of each parallelogram:

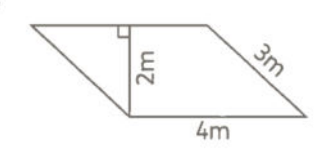
a.




b.




c.



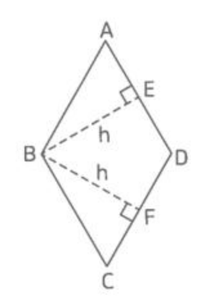

a. ..........................................................................................

b. ..........................................................................................

c. ..........................................................................................



ABCD is a Rhombus.




- $\overline{BF} \perp \overline{CD}$ , $\overline{BE} \perp \overline{AD}$
- $\overline{AB} // \overline{CD}$ and $\overline{AD} // \overline{BC}$.
- $AB = CD = AD = BC$.

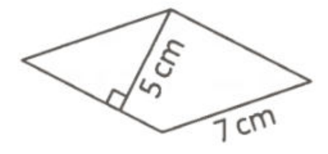


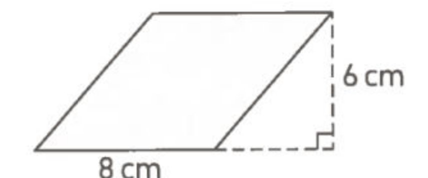
**Rule**

The area of the rhombus = the side length × height
$A = b \times h$



**[4] Find the area of each rhombus:**

a.



b.



a. ..........................................................................................

b. ..........................................................................................



**[5] Find the area of each polygon:**

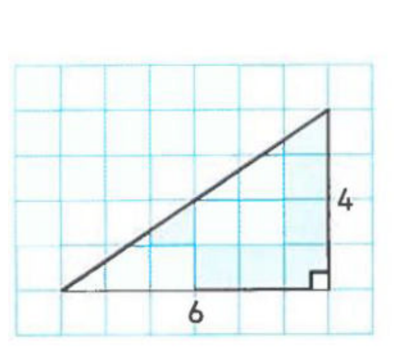
a. Parallelogram: b = 8 cm and h = 9 cm. ..........................................

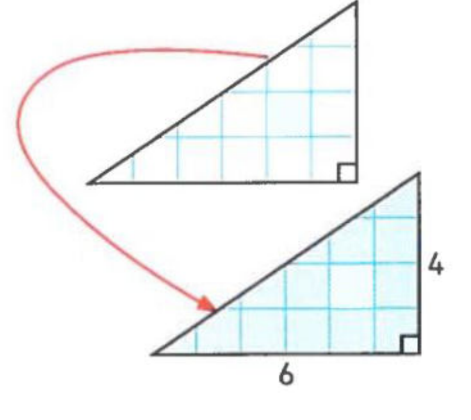
b. Rhombus: S = 7 cm and h = 4 cm. ..........................................

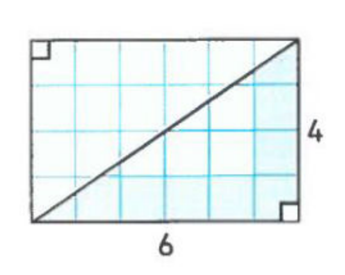
c. Parallelogram: b = 5.4 cm and h = 5 cm. ..........................................



## Lesson (2) Area of Right-angled Triangle



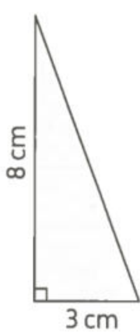



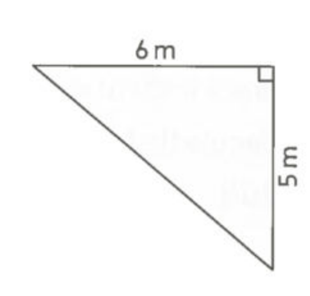
## Rule

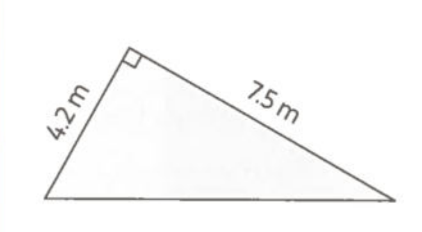
The area of the right-angled triangle = $\frac{1}{2}$ × the base length × height

$$A = \frac{1}{2} \times b \times h$$

**[1] Find the area of each triangle:**

a.



b.



c.


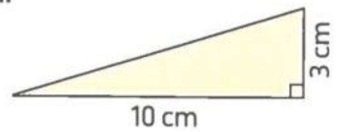

a. ..........................................................................

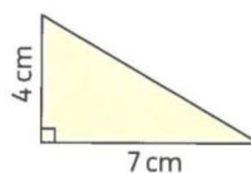
b. ..........................................................................

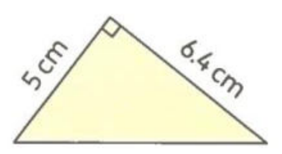
c. ..........................................................................



**[2] Find the area of each triangle:**

a.



b.



c.


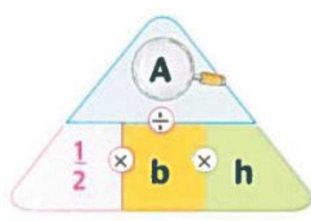

a. ..........................................................................

b. ..........................................................................

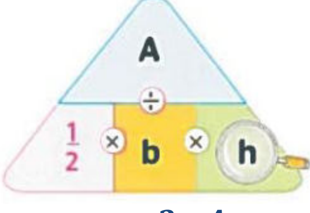
c. ..........................................................................



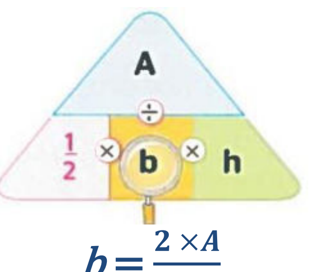
## Remarks




$$A = \frac{1}{2} \times b \times h$$




$$h = \frac{2 \times A}{b}$$




$$b = \frac{2 \times A}{h}$$



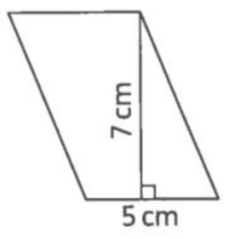
## [3] Find the missing measurement of each triangle:

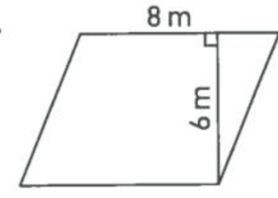
1. b = 8 cm , h = ? cm. , A = 18 cm² ..................
2. b = 5 cm , h = 0.7 cm. , A = ? cm² ..................
3. b = ? cm , h = 7 cm. , A = 14 cm² ..................

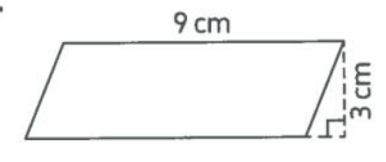


## Homework

## [1] Find the area of each parallelogram:

a.



b.



c.


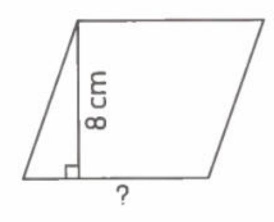

a. ..................

b. ..................

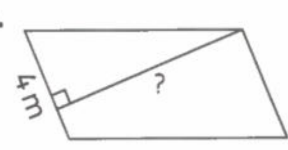
c. ..................



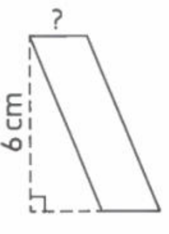
## [2] Find the missing side length in each parallelogram:

a.



[Area = 72 cm²]

b.



[Area = 28 m²]

c.



[Area = 12 cm²]

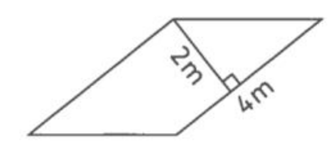
a. ..................

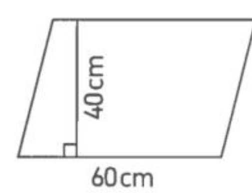
b. ..................

c. ..................



## [3] Find the area of each parallelogram:

a. 

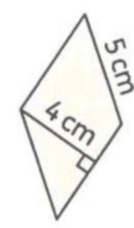

b. 

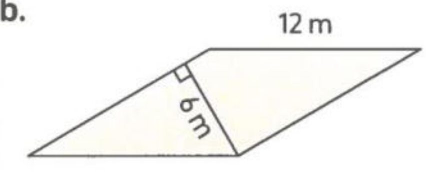

a. ..........

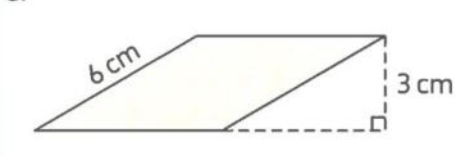
b. ..........



## [4] Find the area of each Rhombus:

a. 


b. 


c. 


a. ..........

b. ..........

c. ..........



## [5] Find the area of each Polygon:

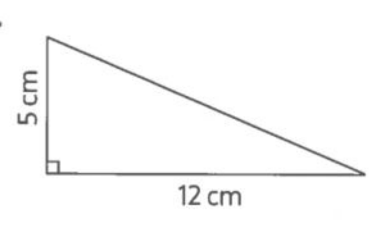
a. Parallelogram: b = 12 cm and h = 7 cm. ..........

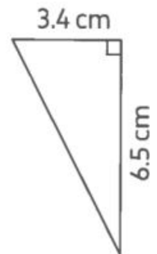
b. Rhombus: S = 11.1 cm and h = 5 cm. ..........

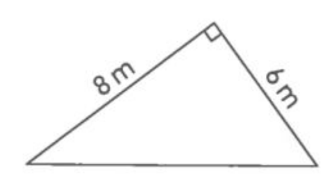
c. Rhombus: b = 6.2 cm and h = 3 cm. ..........



## [6] Find the area of each triangle:

a. 


b. 

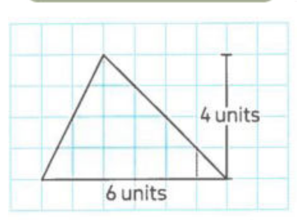

c. 

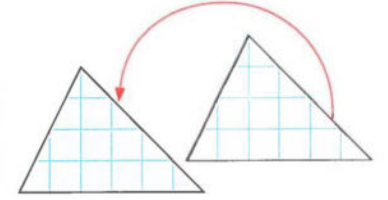
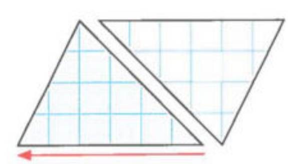
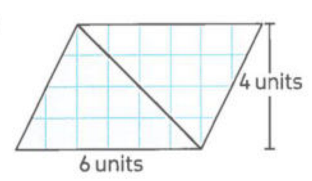

a. ..........

b. ..........

c. ..........

## Lesson (3) Area of Acute and Obtuse Triangles

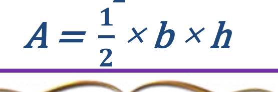


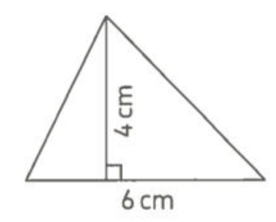

### Rule

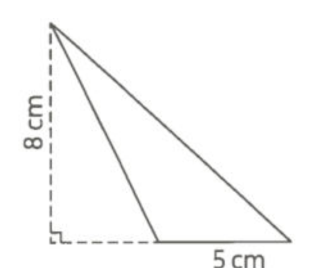
The area of the triangle = $\frac{1}{2}$ × the base length × height

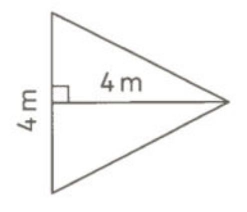
$$A = \frac{1}{2} \times b \times h$$



**[1] Find the area of each triangle:**

a.



b.



c.


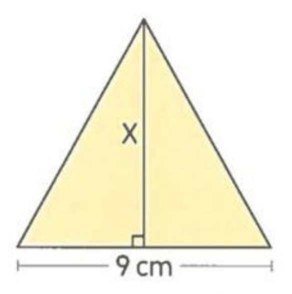

a. ..............................................................................

b. ..............................................................................

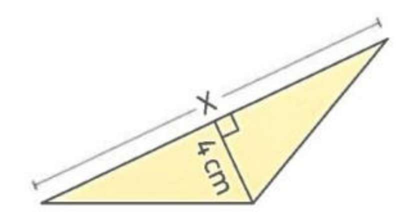
c. ..............................................................................



**[2] Find the value of X:**

a.



Area = 36 cm$^2$

b.


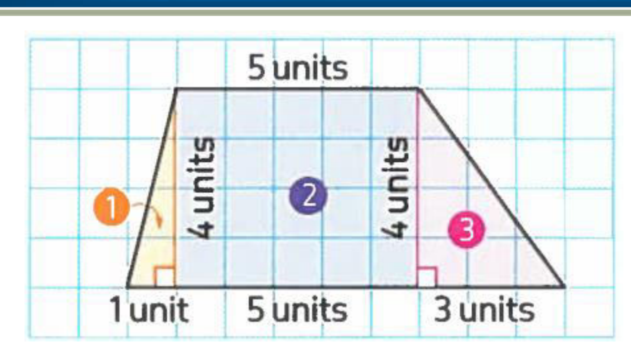

Area = 34 cm$^2$

a. ..............................................................................

b. ..............................................................................



## Lesson (2) Exploring Area of Trapezium




**To find the area of trapezium:**

**[1] Decompose the trapezium into 3 figures as shown.**

**[2] Find the area of each figure:**

Area of fig. (1) $= \frac{1}{2} \times b \times h = \frac{1}{2} \times 1 \times 4 = 2$ sq. units

Area of fig. (2) $= L \times W = 5 \times 4 = 20$ sq. units

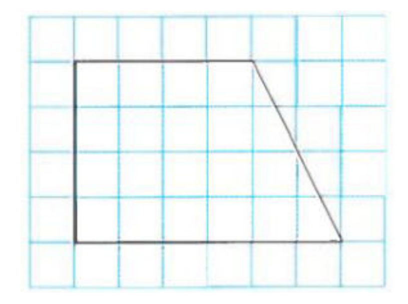
Area of fig. (3) $= \frac{1}{2} \times b \times h = \frac{1}{2} \times 3 \times 4 = 6$ sq. units

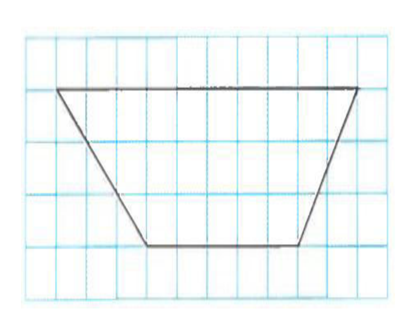
**[3] Find the area of trapezium by adding:**

Area of trapezium $= 2 + 20 + 6 = 28$ sq. units



**[1] Find the area of each trapezium:**





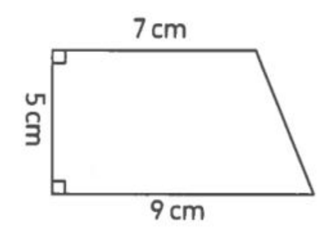
.................................................................... ....................................................................

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.................................................................... ....................................................................

## [2] Find the area of each trapezium:




6 cm
4 cm
2 cm
11 cm

..................................................................

..................................................................

..................................................................

..................................................................

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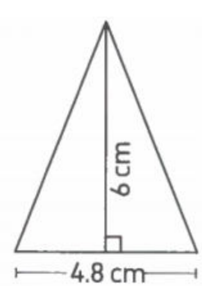
..................................................................

..................................................................

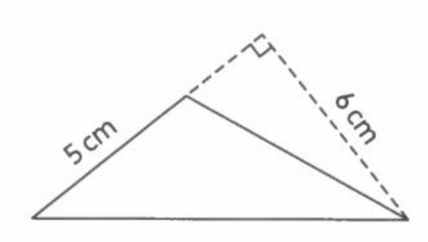



## [1] Find the area of each triangle:

a.




b.



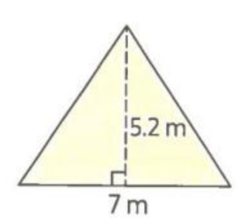

a. ..................................................................

b. ..................................................................

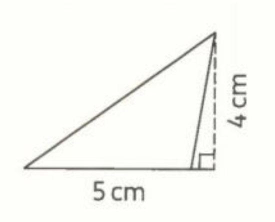


## [2] Find the area of each triangle:

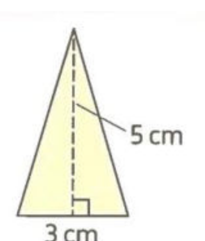
d.




e.




f.



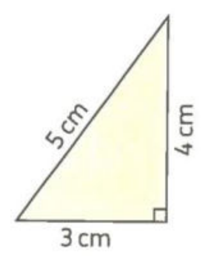

d. ..................................................................

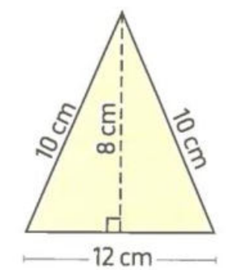
e. ..................................................................

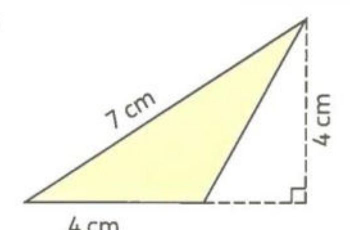
f. ..................................................................



## [3] Find the area of each triangle:

g.



h.



i.


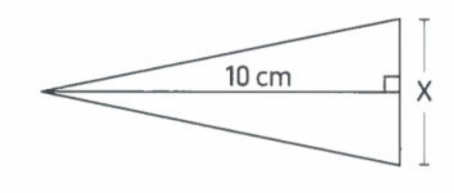

g. ..........................................................................................

h. ..........................................................................................

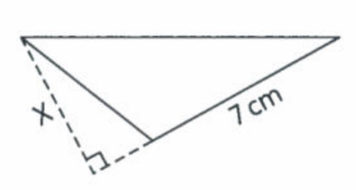
i. ..........................................................................................



## [4] Find the value of X:

a.



Area = 20 $cm^2$

b.


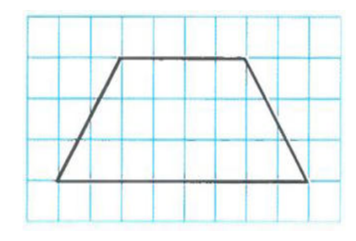

Area = 17.5 $cm^2$

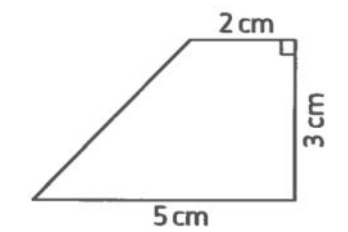
a. ..........................................................................................

b. ..........................................................................................



## [3] Find the area of each trapezium:








..........................................................................................

..........................................................................................

..........................................................................................

..........................................................................................



# Unit (12) Assessment

## [1] Choose the correct answer:

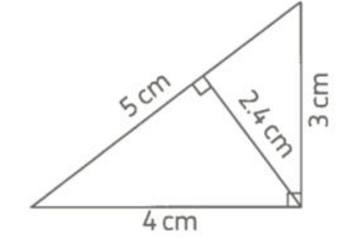
1. Area of a parallelogram = ..........

   A. $\frac{1}{2} \times b \times h$  B. $b \times h$  C. $2 \times b \times h$  D. $\frac{b \times h}{4}$

2. Area of a rhombus whose side length is 2.4 cm and its height is 2 cm is .......... $cm^2$

   A. 4.8  B. 5.6  C. 8  D. 10.2

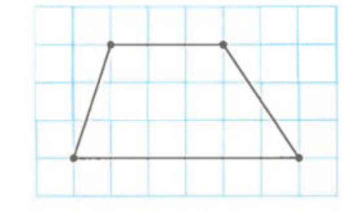
3. Which expression represents the area of the drawn triangle ?




   A. $\frac{1}{2} \times 3 \times 5$  B. $\frac{1}{2} \times 2.4 \times 4$

   C. $\frac{1}{2} \times 3 \times 4$  D. $\frac{1}{2} \times 4 \times 5$

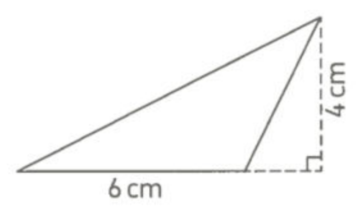
4. The area of the drawn trapezium = .......... square units.



   A. 27  B. 13.5

   C. 18  D. 54

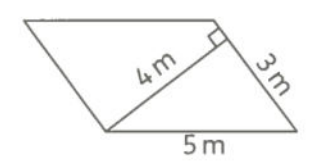
5. The area of the drawn triangle = .......... $cm^2$




   A. 10  B. 12

   C. 24  D. 48

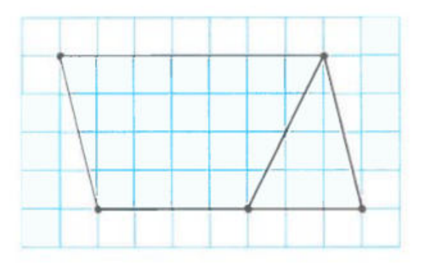
6. The area of the drawn parallelogram = .......... $m^2$




   A. 20  B. 15

   C. 12  D. 8

7. Which of the following expressions does represent the area of the colored trapezium ?



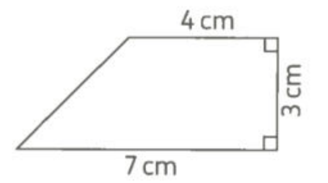
   A. $\frac{1}{2} \times 7 \times 4$  B. $(7 \times 4) + (\frac{1}{2} \times 3 \times 4)$

   C. $(7 \times 4) - (\frac{1}{2} \times 3 \times 4)$  D. $(7 \times 4) - (3 \times 4)$

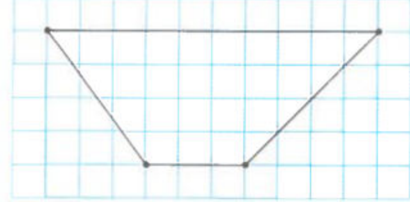


## [2] Complete:

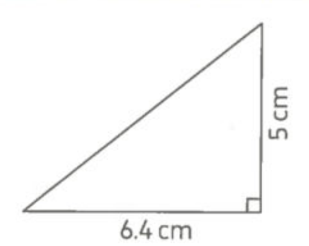
1. If the two dimensions of a parallelogram are 7 cm and 4 cm and its smaller height is 6 cm, then its area is .......... $cm^2$
2. If the area of a rhombus is 24 $m^2$ and its height is 4 m, then its side length is .......... m
3. Area of the opposite trapezium = .......... $cm^2$




4. The area of the triangle whose base length is 4.8 cm and its corresponding height is 1.5 cm is .......... $cm^2$
5. A parallelogram is of area 3.6 $m^2$ and a base length 0.9 m, then its corresponding height is .......... m
6. The area of the opposite trapezium = .......... square units



7. The area of the opposite triangle = .......... $cm^2$

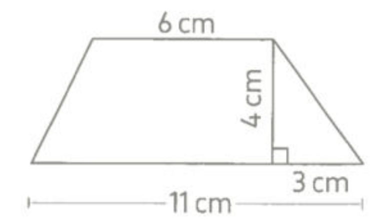



8. If a base length of a parallelogram is 10 m and its corresponding height is 3 m less than it, then the area of the parallelogram is .......... $m^2$

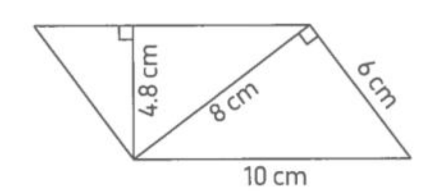


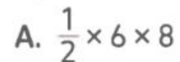
## [3] Choose the correct answer:

1. Area of a triangle = ..........
   A. $2 \times b \times h$ B. $b \times h$ C. $\frac{b \times h}{2}$ D. $3 \times b \times h$
2. A rhombus of side length 14 cm and the ratio between its height and its side length is 5 : 7, then the area of the rhombus is .......... $cm^2$
   A. 35 B. 70 C. 100 D. 140
3. The area of the opposite trapezium = .......... $cm^2$
   A. 30 B. 34
   C. 40 D. 55



4. Which of the following expressions does represent the area of the opposite parallelogram ?



A. $\frac{1}{2} \times 6 \times 8$ B. $6 \times 10$

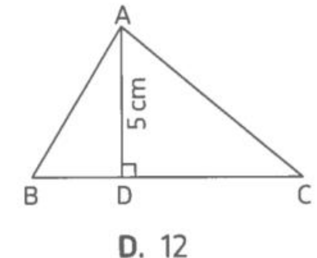
C. $4.8 \times 8$ D. $10 \times 4.85$

5. **In the opposite figure :**

ABC is a triangle in which

$\overline{AD} \perp \overline{BC}$ , AD = 5 cm , area of $\Delta$ ABC = 15 $cm^2$

, then BC = .......... cm

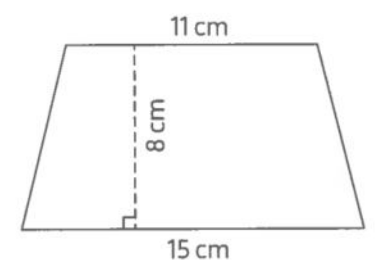



A. 3 B. 6 C. 9 D. 12

6. If the dimensions of a parallelogram are 10 m and 6 m and its greater height is 5 m, then its smaller height is .......... m

A. 3 B. 30 C. 50 D. 60

7. The area of the opposite trapezium = .......... $cm^2$




A. 96 B. 100

C. 104 D. 116



1. A triangle is of base length 5 cm and its corresponding height is 2 cm more than it. **Find the area of the triangle.**

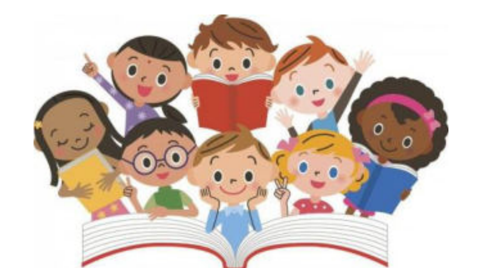
2. Find the area of the rhombus whose perimeter is 20 cm and its height is 3.4 cm.

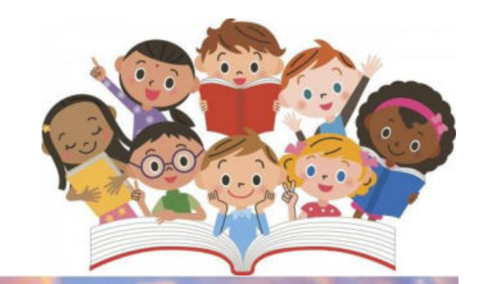
3. **Which is greater in area ?**

A parallelogram whose base length is 12 cm and its corresponding height is 10 cm or a rectangle whose dimensions are 14 cm and 8 cm.









UNIT 13

Theme 4 | Applications of Geometry and Measurement

# Surface Area and Volume

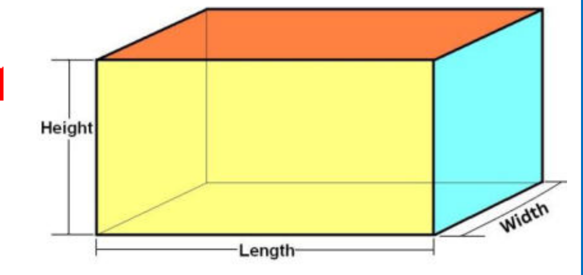
# Concept (1): Use Nets to Find Surface Area

## Lesson (1) Surface Area of Cuboid

**Surface area of a 3 dimensional shape**

is the sum of the areas of all faces of the shape




**Cuboid (Rectangular prism) is a 3 dimensional shape (solid) has:**

6 Faces

12 Edges

8 Vertices

All faces are rectangles or rectangles and squares

Each two opposite faces are congruent



***NOTE:***

Each two opposite faces are congruent as: "top and bottom faces are congruent." so, the two faces are equal in area.

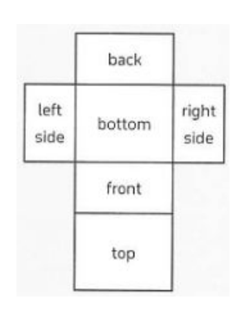
Area of rectangle = length × width = $l \times w$

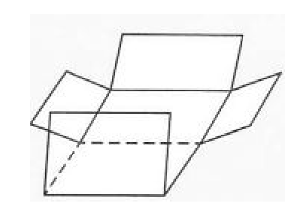
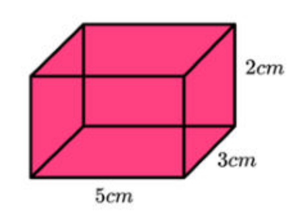





## Part (A): Cuboid and nets

**Ex: calculate the area of the opposite figure**




### First solution:

The surface area = area of front + area of back + area of left side + area of right side + area of bottom + area of top

The surface area = 15 + 15 + 10 + 10 + 6 + 6 = 62 $cm^2$

### Another solution

The surface area = 2 × area of front + 2 × area of left side + 2 × area of bottom

The surface area = 2 × 15 + 2 × 10 + 2 × 6 = 62 $cm^2$

### Third solution

The surface area = 2 × [area of front + area of left side + area of bottom]

The surface area = 2 × [15 + 10 + 6] = 2 × 31 = 62 $cm^2$

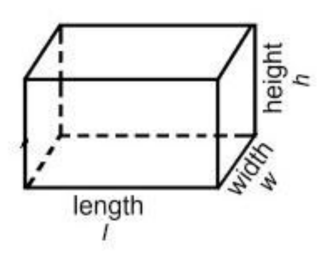


### The surface area of a cuboid [SA]

= l w + l w + l h + l h + w h + w h

= 2 × [l w] + 2 × [l h] + 2 + [w h]

= 2 × [l w + l h + w h]











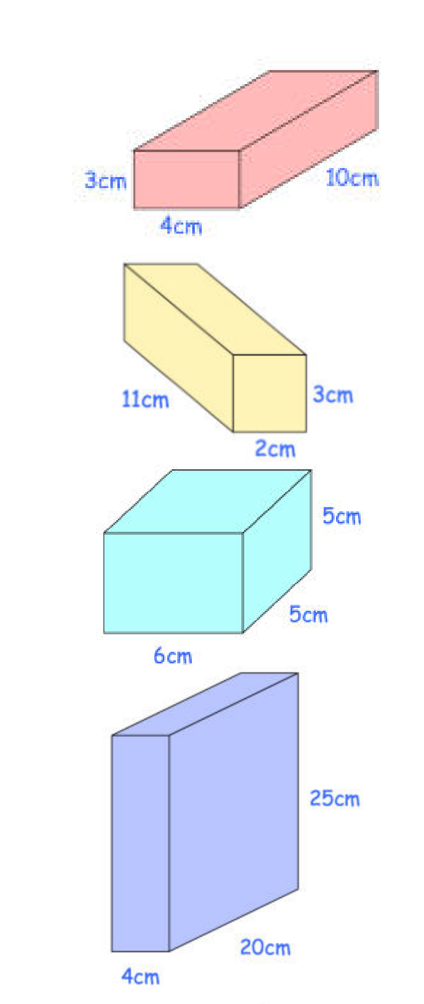
## *Ex:* [1] Find the surface area of each cuboid:

**(12)** Surface area=……….

**(13)** Surface area=……….

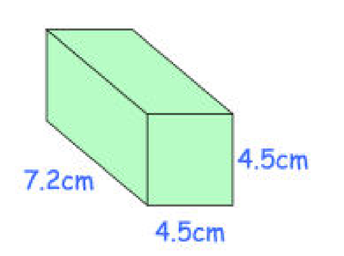
**(14)** Surface area=……….

**(15)** Surface area=……….




**(16)** Surface area=……….

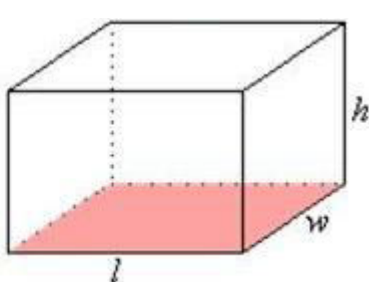
**(17)** Surface area=……….






**[2]** Write formula for the opposite cuboid that could use to find the surface area of the cuboid given that L is the length, w is the width and h is the height

…………………………………………………



## [3] Complete the table:

| Cuboid | Length | Width | Height | Surface area |
|---|---|---|---|---|
| a. | 3 cm | 2 cm | 4 cm | ........................................ |
| b. | 5 m | 4 m | 6 m | ........................................ |
| c. | 70 mm | 30 mm | 60 mm | ........................................ |
| d. | 5.5 m | 0.5 m | 3.2 m | ........................................ |



## Part (B): Cubes and nets

**Note:** Cube is a special case of cuboid in which all faces are squares




### Cube is a 3 dimensional shape (solid) has:

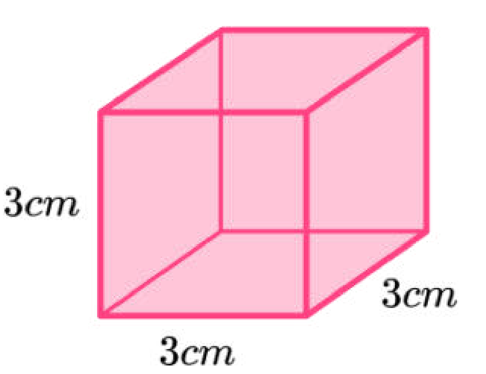
- 6 Faces
- 12 Edges
- 8 Vertices
- All faces are squares
- All faces are congruent, so all faces are equal in area
- Area of square = side(s) × side(s) = side² ($s^2$)

  =side(s) × it self

s
back
s s
left side | bottom | right side
s front
s top



## Calculate the surface area of the opposite cube




Surface area = $s^2 + s^2 + s^2 + s^2 + s^2 + s^2$
$= 9 + 9 + 9 + 9 + 9 + 9 = 54\ cm^2$

Surface area = $6\ s^2$
$= 6 \times s \times s$
$= 6 \times 3 \times 3 = 54\ cm^2$

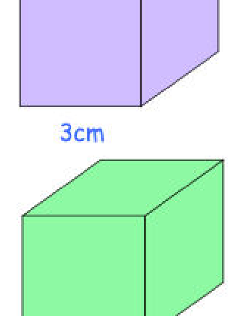
**Surface area of a cube [SA]**

Surface area = 6 × area of one face = $6 \times s \times s = 6\ s^2$



## *Ex:* [1] Find the surface area of each cuboid:

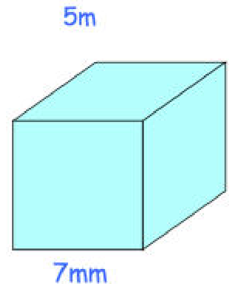
(1) Surface area = ……….



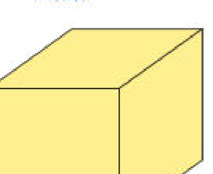

(2) Surface area = ……….



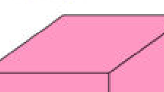
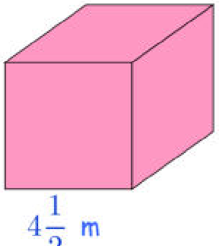
(3) Surface area = ……….




(4) Surface area = ……….




(5) Surface area = ……….

## [3] Complete the table:

| Cube | Side | Surface area |
|---|---|---|
| a. | 4 cm | ............... |
| b. | 8 m | ............... |
| c. | 33 mm | ............... |
| d. | 4.8 m | ............... |




## [1] Choose the correct answer:

(1) The surface area of a rectangular prism of length 9 cm, width 4 cm and height 8 8 cm is .......$cm^2$

ⓐ 576 ⓑ 42 ⓒ 140 ⓓ 280

(2) The surface area of a cube with side length 6 cm is ..........$cm^2$

ⓐ 18 ⓑ 216 ⓒ 96 ⓓ 36

(3) The surface area of the cube = .......

ⓐ $S \times S \times S$ ⓑ $6 \times S^2$ ⓒ $6 \times (S+S)$ ⓓ $(S \times S) + 6$

(4) The surface area of a cuboid = .......

ⓐ $L \times w \times h$ ⓑ $Lw + Lh + wh$ ⓒ $2(Lw+Lh+wh)$ ⓓ $L+w+h$

(5) How much cardboard is needed to make a box with a length of 2.5 m, a width of 1.6 m, and a height of 2 m ?

ⓐ 37.5 $m^2$ ⓑ 24.4 $m^2$ ⓒ 8 $m^2$ ⓓ 6.1 $m^2$

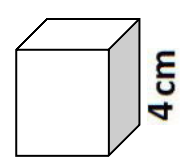
**(6)** Which of following expressions represents the surface area of a cube with side length w ?

ⓐ $w^3$ ⓑ $6\ w^2$ ⓒ $6\ w^3$ ⓓ $2\ w + 5\ w^2$

**(7)** The side length of the cube which its surface area equals 96 $m^2$ equals ……..

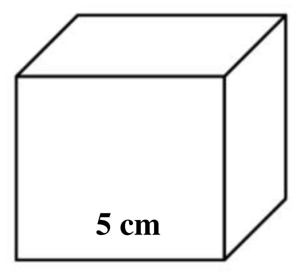
ⓐ 2 m ⓑ 3 m ⓒ 4 m ⓓ 5 m

**(8)** The surface area of the opposite cube is ……



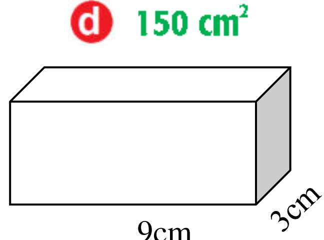

ⓐ 12 $cm^2$ ⓑ 24 $cm^2$ ⓒ 52 $cm^2$ ⓓ 104 $cm^2$

**(9)** The surface area of the opposite cube is ……




ⓐ 25 $cm^2$ ⓑ 50 $cm^2$ ⓒ 75 $cm^2$ ⓓ 150 $cm^2$

**(10)** The surface area of the opposite cuboid is




ⓐ 150 $cm^2$ ⓑ 135 $cm^2$ ⓒ 130 $cm^2$ ⓓ 137 $cm^2$





**(11)** Choose all the methods that are valid for finding the surface area of the cuboid?

ⓐ Sum the area of each face.

ⓑ Add the area of the top, right side , left side and multiply the sum by 2.

ⓒ Multiply the area of the top by 2, the area of the right side by 2, and the area of the front by 2 then add the products.

ⓓ Add the areas of bottom, front and right side, multiply the sum by 2.

Ⓔ Add the areas of the bottom, back and left side.

**(12)** Suppose you know that the side length of a cube is s units which of these expressions could be used as a formula for the surface area of the cube? choose all that apply

a) $6\ s^2$

b) $s^2 + s^2 + s^2$

c) $2(s)(s)+2(s)(s)+2(s)(s)$

d) $6 \times s \times s$

E) $12\ s$



## [2] Complete:

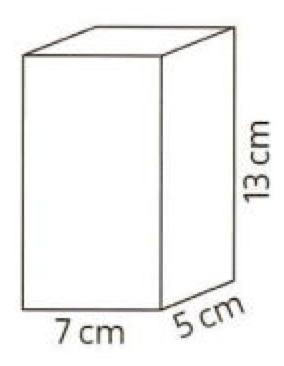
**(1)** The surface area of a cuboid of length 7.4 cm, width 1.8cm and height 3.5 cm is …….$cm^2$

**(2)** The surface area of a cube is 150 $m^2$ then its side length is …….m

**(3)** A cuboid its base is a square of side length 6.8 cm and height 5 cm then its surface area is ……$cm^2$

**(4)** The volume of the cuboid whose dimensions are 6.5 m.$4\frac{1}{4}$m and 5 m is …………$m^3$

**(5)** The surface area of the opposite cuboid is ………..$cm^3$




**(6)** The surface area of the cuboid whose length is 12cm, its width 8cm and its height is 9cm equals ……....$cm^2$



## Essay questions

[1] Jessica wants to decorate her new bookshelf. The dimensions of the bookshelf are 80 cm, 60 cm, and 30 cm. She plans to cover the entire surface of the bookshelf with decorative paper. What is the total area of the bookshelf that she needs to cover?

[2] Sarah is wrapping a gift box for her friend. The length, width, and height of the gift box are 15 cm, 10 cm, and 6 cm, respectively. How much wrapping paper does Sarah need to completely cover the gift box?

[3] John wants to store some toys in a rectangular container. The length, width, and height of the container are 12 cm, 8 cm, and 5 cm, respectively. What is the surface area of the container that John needs to label?

[4] Mia bought a gift in the shape of a cube for her friend's birthday. The length of each side of the gift's box is 5 cm. What is the total surface area of the gift box that Mia needs to wrap with decorative paper?

[5] A painter paints a door before he installs it. The door is 178 cm high, 80 cm long and 5 cm wide. Find the surface area of the door so that the painter can figure out how much paint to buy.

[6] Nada made a cubical box out of sheet metal for an art project. The side length of the box is 8 cm. What is the surface area of the sheet metal did she use?

[7] Find the surface area of the following:

(1) A cuboid that has a length of 9 cm, a width of 4 cm and a height of 5 cm

(2) A cuboid that has a length of 4.2 m, a width of 3 m and a height of 1.5m

(3) A cube of side length 5.3m

(4) A cube where the perimeter of one of its faces is 26cm

(5) A cuboid that has a square base of side length 6 cm and a height of 9 cm

# Lesson (2) Exploring Surface Area of Prism and Pyramid

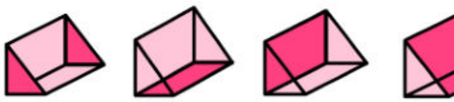
## Part 1: Surface area of triangular prism

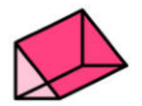
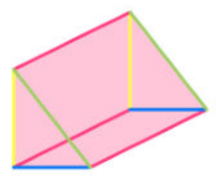
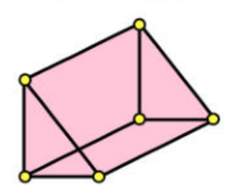
**The surface area of a triangular prism is the sum of the areas of all face.**




Triangular Prisms have: 2 congruent triangular faces and three rectangular faces

- 5 faces
- 9 edges
- 6 vertices

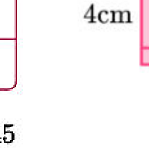


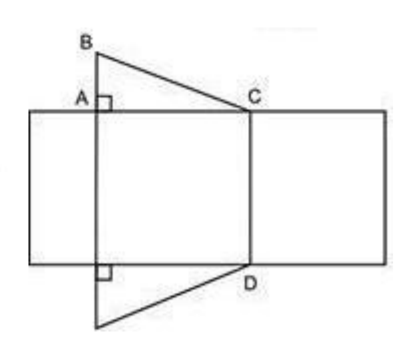





**Area of rectangle = length (l) × width (w)**

**Area of triangle = $\frac{1}{2}$ base (b) × height (h) = $\frac{1}{2}$ × b × h**

| Face | Area |
|---|---|
| Front | $\frac{1}{2} \times 3 \times 4 = 6$ |
| Back | 6 |
| Bottom | $3 \times 9 = 27$ |
| Left side | $4 \times 9 = 36$ |
| Right side | $5 \times 9 = 45$ |




$$\text{Total surface area} = 6 + 6 + 27 + 36 + 45$$
$$= 120\text{cm}^2$$

**Surface area of a triangular prism (SA) = area of 3 rectangular faces * area of 2 triangular bases**

## Notes:

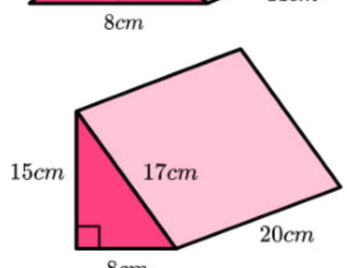
- **If the triangular bases are isosceles triangles, then two of the rectangular faces will be congruent.**
- **If the triangular bases are equilateral triangles, then all of the three rectangular faces will be congruent.**

## [1] Find the surface area of each triangular prism:

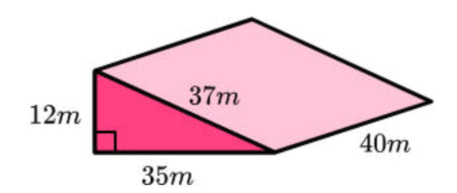
**(1)** Surface area=……….

5cm 5cm 3cm 11cm 8cm

**(2)** Surface area=……….




**(3)** Surface area=……….





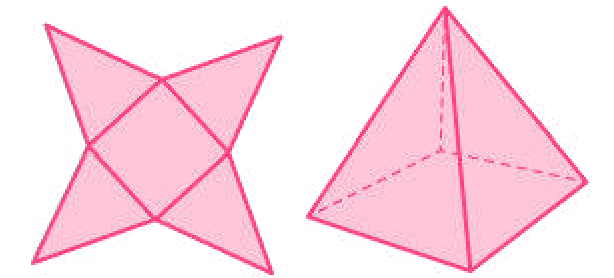

## Part 2: Surface of a square pyramid

**The surface area of a square pyramid is the sum of the areas of all faces.**





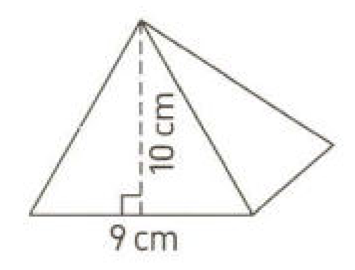

- Square based pyramid has 8 edges
- 5 vertecies
- 5 faces
- 4 congruent triangular faces
- 1 squared base



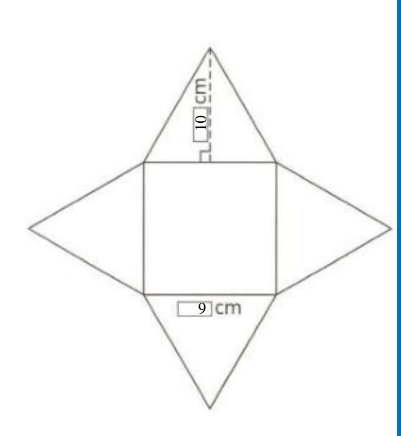
Area of square = $s^2$

Area of triangle = $\frac{1}{2}$ b h

**Calculate the surface area of the opposite square pyramid**




| Face | Area |
|---|---|
| Triangular face | $\frac{1}{2}$ b h = $\frac{1}{2} \times 9 \times 10 = 45$ cm$^2$ |
| Square base | $s^2 = 9^2 = 81$ cm$^2$ |




**Surface area** = Area of base + 4 × Area of triangular faces

= 81 + (4 × 45)

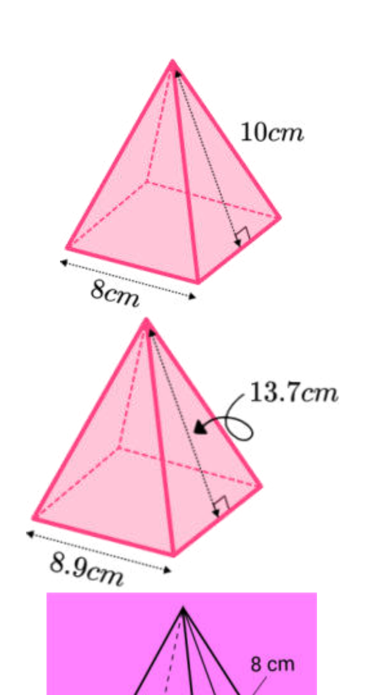
= 81 + 180

=261 cm$^2$

**Surface area of square pyramid (SA)** = Area of base + 4 × Area of triangular faces



## [1] Find the surface area of each square pyramid:




(1) Surface area=……….

(2) Surface area=……….

(3) Surface area=……….

8 cm
5 cm



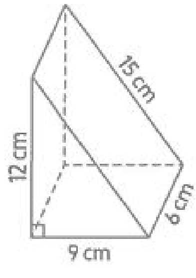
# Homework

## [1] Choose the correct answer:

**(1)** The surface area of a square pyramid if the side length 8 cm and the height of the triangular face is 9 cm is ..........

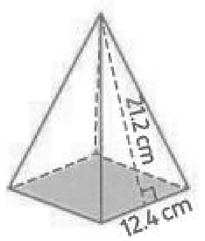
ⓐ 100  ⓑ 136  ⓒ 352  ⓓ 208

**(2)** The surface area of the following triangular prism is ........... $cm^2$



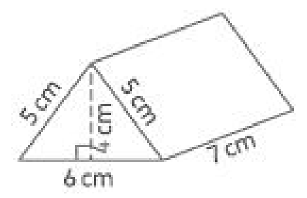

ⓐ 324  ⓑ 234  ⓒ 810  ⓓ 648

**(3)** The surface area of the opposite square based pyramid is ........... $cm^2$



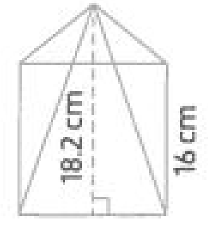

ⓐ 1205.28  ⓑ 67952  ⓒ 525.76  ⓓ 679.52

**(4)** The surface area of the opposite triangular prism is ........... $m^2$

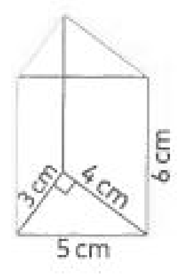



ⓐ 24  ⓑ 112  ⓒ 136  ⓓ 163

**(5)** The surface area of the opposite square based pyramid is ........... $cm^2$




ⓐ 886.4  ⓑ 838.4  ⓒ 834.8  ⓓ 388.4




**(6)** The surface area of the opposite triangular prism is ………… $cm^2$

ⓐ 72 ⓑ 42 ⓒ 84 ⓓ 60

**(7)** The surface area of a square has ……..

ⓐ 3 triangles, 2 rectangles ⓑ 2 triangles, 4 rectangles ⓒ 2 triangles, 3 rectangles ⓓ 4 triangles, 2 rectangles

**(8)** Which of the following statements shows the number of faces of a square pyramid?

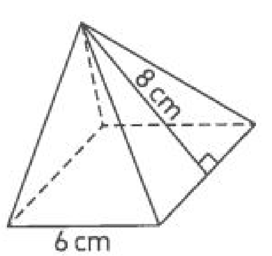
ⓐ 3 triangles, 1 square ⓑ 2 triangles, 2 squares ⓒ 4 triangles, 2 squares ⓓ 4 triangles, 1 square

**(9)** Which of the following statements shows the number of faces of a triangular prism?

ⓐ 3 triangles, 2 rectangles ⓑ 2 triangles, 4 rectangles ⓒ 2 triangles, 3 rectangles ⓓ 4 triangles, 2 rectangles

**(10)** Which of the following statements shows the number of faces of a square pyramid?

ⓐ 3 triangles, 1 square ⓑ 2 triangles, 2 squares ⓒ 4 triangles, 2 squares ⓓ 4 triangles, 1 square



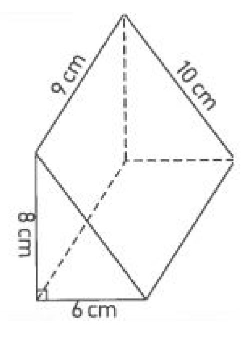

**(12)** Which of the following expressions represents the surface area of the opposite square pyramid?

ⓐ $(6\times6)+(\frac{1}{2}\times 6 \times 8)$ ⓑ $(6\times6)+[4\times(\frac{1}{2}\times 6 \times 8)]$

ⓒ $(6\times8)+[4\times(\frac{1}{2}\times 6 \times 6)]$ ⓓ $(6\times8)+[3\times(\frac{1}{2}\times 6 \times 6)]$

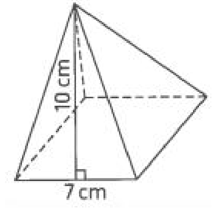







**(12)** The surface area of the opposite triangular prism is ………..$cm^2$

ⓐ 264 ⓑ 138 ⓒ 240 ⓓ 306




**(13)** The surface area of the opposite square pyramid is ………..$cm^2$

ⓐ 114 ⓑ 189 ⓒ 223 ⓓ 256

**(14)** The surface area of the square pyramid In which the perimeter of its base is 36 cm and the height of each triangular face Is 6 cm equals $cm^2$

ⓐ 164 ⓑ 170 ⓒ 189 ⓓ 212

**(15)** If the ratio between the area of the equilateral triangular base and the area of the rectangular face In a triangular prism is 2 : 3 and the area of one triangular face 12 $cm^2$ ,then the surface area of the triangular prism is ………… $cm^2$

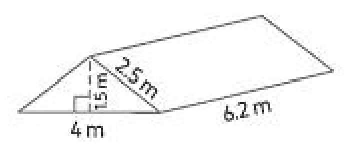
ⓐ 60 ⓑ 70 ⓒ 78 ⓓ 84



## [2] Complete:

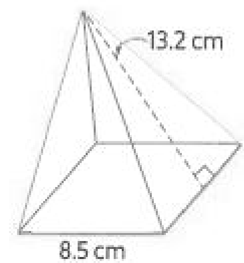
**(1)** The triangular prism has …………… rectangular faces.

**(2)** The surface area of the opposite triangular prism is …………. $cm^2$





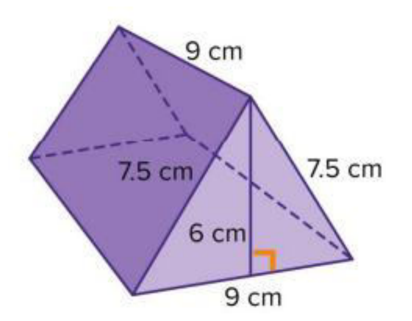

**(3)** The surface area of the opposite squared based pyramid is ............ $cm^2$






## [3] Essay questions:

**(1)** If a student is making a miniature representation of a camping scene, using fabric to make a small enclosed tent as shown. How much fabric is needed?





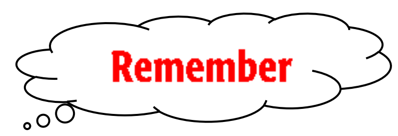

**(2)** The pyramid of Menkaure is the o smallest of the pyramids of Giza. The square base has a side length of about 104 meters. The height of each triangular face is about 84 m. What is the surface area of the pyramid, including the floor?



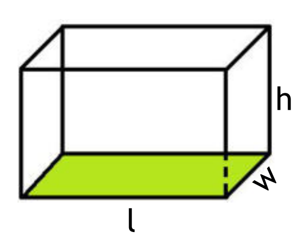
# Concept (2): Calculate Volume

Lesson (3) — Applications on Volume
Lesson (4) — Volume of Cuboid with Known Ratios

## Part 1: Applications on volume



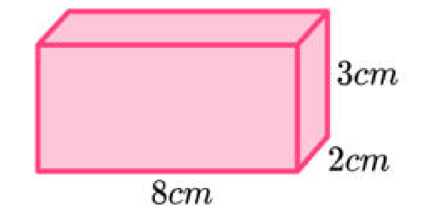

Volume of cuboid (v) = length × width × height = l × w × h
=base area × height = b × h



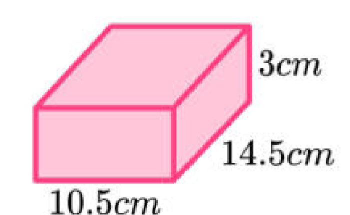



***Ex:*** **[1] Find the volume of each cuboid:**

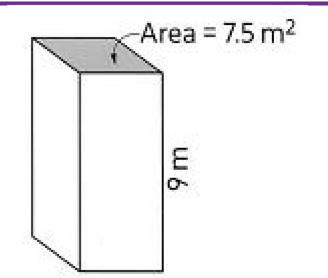
**(1)** Volume =……….



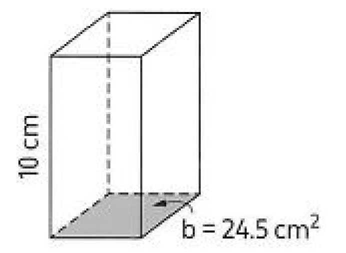

**(2)** Volume =……….




**(3)** Volume =……….



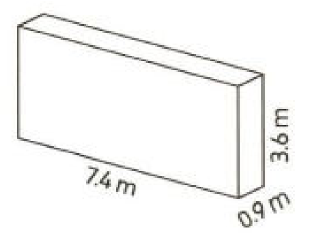

**(4)** Volume =……….



## [2] Estimate the volume of each cuboid, then find its actual volume.

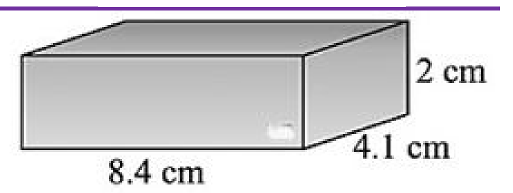
(1) Estimation = ……….

Actual Volume =……….




(2) Estimation = ……….

Actual Volume =……….




## Part 2: Volume of cuboid with known ratios

**Doubling one or more of the dimensions of a cuboid affects its volume.**

| | Length [cm] | Width [cm] | Height [cm] | Volume [$cm^3$] |
|---|---|---|---|---|
| Original cuboid | 3 | 2 | 5 | 30 |
| Doubling one dimension | 6 | 2 | 5 | 60 |
| Doubling two dimension | 6 | 4 | 5 | 120 |
| Doubling three dimension | 6 | 4 | 10 | 240 |

### From the previous table, we deduce that:

- The ratio of the new volume to the original volume when you doubled one dimension is 2 : 1 [60 : 30 = 2 : 1]
- The ratio of the new volume to the original volume when you doubled two dimensions is 4 : 1 [120 : 30 = 4 : 1]
- The ratio of the new volume to the original volume when you doubled three dimensions is 8 : 1 [240 : 30 = 8 : 1]



## Notes:

- If one dimension of a cuboid is tripled, then the ratio of the new volume to the original volume is 3 : 1
- If two dimensions of a cuboid are tripled, then the ratio of the new volume to the original volume is 9 : 1
- If three dimensions of a cuboid are tripled, then the ratio of the new volume to the original volume is 27 : 1
- If one dimension of a cuboid is divided to half (replaced by its half), then the ratio of the new volume to the original volume is 1 : 2




### [1] Choose the correct answer:

(1) The volume of the opposite cuboid is ………….. $m^3$

1.8 m

Area = 36 $m^2$

ⓐ 96 ⓑ 64.8 ⓒ 75.24 ⓓ 58.8

(2) The volume of a cuboid of dimensions 12cm,9.5cm and4 cm is ……….. $cm^3$

ⓐ 484.5 ⓑ 434 ⓒ 43.44 ⓓ 48.44

(3) The volume of a cuboid whose length 9 cm ,width 5 cm and height 8 cm is ………… $cm^3$

ⓐ 360 ⓑ 157 ⓒ 314 ⓓ 626

(4) The volume of a cuboid of a square base of side length 14.2 cm and height $6\frac{1}{2}$ cm is ………$cm^3$

ⓐ 553.8 ⓑ 806.56 ⓒ 1,209.84 ⓓ 1,310.66

**(5)** The volume of a cuboid of dimensions 7.4 cm ,5.8 cm and 10.1 cm is …………… $cm^3$

ⓐ 24.3   ⓑ 508.232   ⓒ 387.48   ⓓ 193.74

**(6)** If the volume of a cuboid is 646.94 $cm^3$ and one of its dimensions is doubled, then the new volume is ………… $cm^3$

ⓐ 323.49   ⓑ 1,293.88   ⓒ 1,940.92   ⓓ 646.94

**(7)** The volume of a cuboid of base area 28 $cm^2$ and height 7.4 cm is ………… $cm^3$

ⓐ 270.2   ⓑ 207.2   ⓒ 202.7   ⓓ 207.7

**(8)** If the height of a cuboid is divided in half then the ratio between the new volume to the original volume is ………….

ⓐ 2 : 1   ⓑ 4 : 2   ⓒ 1 : 2   ⓓ 2 : 3

**(8)** Which of the following is the base area for the volume of the following cuboid equals 110 $cm^3$?

5.5 cm

ⓐ 10 $cm^2$   ⓑ 20 $cm^2$   ⓒ 40 $cm^2$   ⓓ 50 $cm^2$

**(9)** In the cuboid, if its height is doubled, then the ratio of the new volume to the original volume of the cuboid is……..

ⓐ 1 : 2   ⓑ 2 : 1   ⓒ 1 : 8   ⓓ 8 : 1

**(10)** A building in the shape of a cuboid, its height is 14 m. length is 12.5m and width is $9\frac{1}{4}$ m, then its volume is …………..$m^3$

ⓐ 1,618.75   ⓑ $1,786\frac{1}{4}$   ⓒ 1,800   ⓓ 2,057.75

**(11)** A cuboid of volume 214 $cm^3$, all of its dimensions are doubled, then the new volume of the cuboid is ……….$cm^3$

ⓐ 428   ⓑ 856   ⓒ 1,712   ⓓ 1,926

**(12)** 3 boxes of pizza, the width of each box is 25 cm, the height of each box is 5 cm, the length of the first box is 30 cm and each box adds 2.5 cm to the previous box's length, then the total volume of the 3 boxes = ……….. $cm^3$

ⓐ 10,665   ⓑ 12,187.5   ⓒ 14,375.5   ⓓ 16,554

## [2] Complete:

(1) The volume of a cuboid of base area 44.8 $cm^2$ and height 15.5cm is ……… $cm^3$

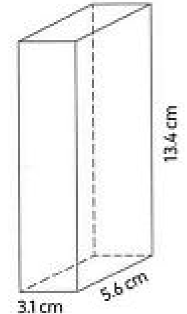
(2) A cuboid of a square shaped base of side length 15 cm and height 8 cm then its volume is ………… $cm^3$

(3) If the volume of a cuboid is 240 $cm^3$ and all the dimensions are doubled ,then the new volume is ………… $cm^3$

(4) The volume of a cuboid of dimensions 12.2cm ,15.1 cm and 10 cm is …….. $cm^3$

(5) The volume of a cuboid which base is a square of side length 12 cm and height16.5 cm is ……….. $cm^3$

(6) If two dimensions in a cuboid are tripled ,then the ratio between the original volume and the new volume is ………….




(7) The volume of the opposite cuboid is …………. $cm^3$

(8) The volume of cuboid = ………×………×……….

(9) The volume of cuboid = ………× height

(10) If one dimension of a cuboid is doubled, then the ratio of the new volume to the original volume in the simplest form is ……….

(11) If one dimension of a cuboid is divided to half, then the ratio of the new volume to the original volume in the simplest form is ……….

(12) A cuboid of volume 200 $cm^3$, if its length is doubled, then the new volume of the cuboid is ……….. $cm^3$

(13) A cuboid of volume $24\frac{1}{2}$ $m^3$, if its dimensions are doubled, then the new volume of the cuboid is ……….. $m^3$

(14) A cuboid of volume 36.4 $cm^3$, if the two dimensions of the base are doubled, then the new volume of the cuboid is ……….. $cm^3$

(15) The volume of a cuboid is $67\frac{4}{5}$ $m^3$, if its height is divided in half, then the new volume of the cuboid is ……….. $m^3$



## [3] Essay questions:

a. Find the volume of the cuboid whose dimensions are 5 cm,6 cm and 7 cm

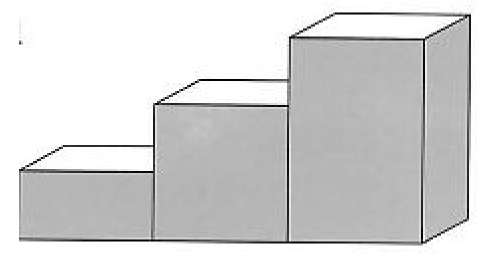
b. Find the volume of the cuboid whose base area is $90\frac{1}{2}$ cm$^2$ and its height is $5\frac{1}{2}$ cm

c. A cuboid of a square-shaped base whose perimeter is 240 cm and its height is 36 cm. Calculate its volume.

d. A cuboid whose dimensions are 6.3 cm,3.1 cm and 7.2 cm, estimate its volume, then find its actual volume.

e. Find the volume of the cuboid hose dimensions are 6.5 cm, 7cm and 10 cm.

**f.** A contractor is building a frame for three steps that will lead up to the front door. Each frame will have the same length and width, but each height will be different. He needs to determine the total volume in order to know how much concrete to buy.



The length of each step is 40 centimeters. The width of each step is 20.25 cm. The height of the first step is 20.25 cm, and each step adds 20.25 cm to the previous step's height.

**a.** A builder tells the contractor that he would use the formula V = bh in this situation to figure out the volume of each step quickly. Do you agree with him ? Why or why not?

**b.** The builder estimates the first step to have a volume of 16000 cubic centimeters. Do you think the actual volume will be more or less than that? Explain why.

**c.** How would you estimate the volume of the next 2 steps?

**d.** What is the actual total volume of the 3 steps?

**g.** Analyze the following statements about tripling and having the dimensions of a right cuboid. Choose all of the true statements.

- (a) If you triple one dimension, the ratio of the new volume to the original will be 3 : 1
- (b) If you triple all 3 dimensions, your original volume will triple
- (c) If you divide one dimension in half, the ratio of the new volume to the original volume will be 2 : 1
- (d) If you divide one dimension in half, the ratio of the original volume to the new volume will be 2 : 1

# Unit (13) Assessment

## [1] Choose the correct answer:

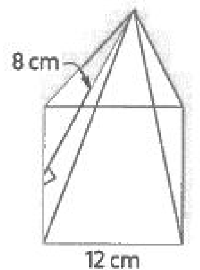
**(1)** The surface area of a cuboid = .......

ⓐ L × w × h ⓑ Lw + Lh +wh ⓒ 2(Lw+Lh+wh) ⓓ L+w+h

**(2)** The surface area of a cube of side length 4.8 mm is .......$mm^2$

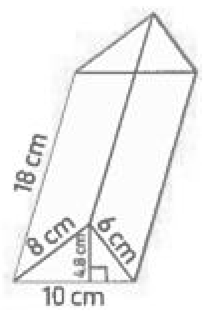
ⓐ 28.8 ⓑ 110.592 ⓒ 138.24 ⓓ 115.2

**(3)** The surface area of the following square based pyramid is .......... $cm^2$




ⓐ 360 ⓑ 336 ⓒ 528 ⓓ 240

**(4)** The surface area of the following triangular prism is .......... $cm^2$




ⓐ 369 ⓑ 396 ⓒ 480 ⓓ 864

**(5)** The volume of a cuboid of dimensions 15.2 cm ,9.5 cm and 6.8cm is ........ $cm^3$

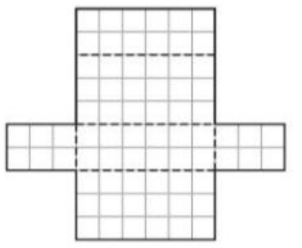
ⓐ 981.92 ⓑ 918.29 ⓒ 980 ⓓ 981.29

**(6)** The volume of a cuboid of the base area 38.14 $cm^2$ and height 7.3 cm is ............ $cm^3$

ⓐ 422.278 ⓑ 278.422 ⓒ 278.224 ⓓ 422.872

**(7)** If the three dimensions of a cuboid are doubted, then the ratio between the new volume to the original volume of the cuboid is

ⓐ 8 : 1 ⓑ 1 : 8 ⓒ 4 : 1 ⓓ 1 : 4

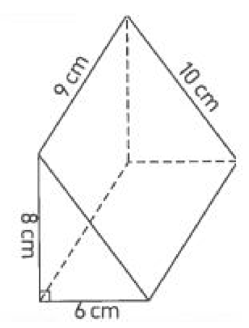


**(8)** The surface area of the cuboid is ……… square units

ⓐ 30 ⓑ 40 ⓒ 33 ⓓ 35



## [2] Complete:

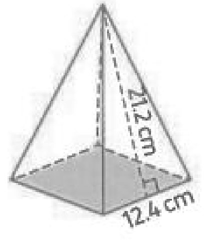



**(1)** The surface area of a cube whose side length is s = ……….

**(2)** The volume of a cuboid = ……….

**(3)** The surface area of the opposite triangular prism is …………$cm^2$






**(4)** The surface area of the opposite square based pyramid is ……… $cm^2$



## [3] Essay questions:

**(1)** Find the volume of the cuboid whose dimensions are 6.4cm,3cm and 7.2cm

**(2)** Ahmed wants to paint each face of his cube with a different color. If the length of each side of the cube is 4 cm, how much paint will he need in total?